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EXSTROPHY OF THE BLADDER[1]

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EXSTROPHY of the bladder occurs, according to Spooner, four times in 116,000 births, and according to Neudoerfer, once in 50,000 births. It has been observed in 95 instances in the Mayo Clinic since 1901.

Statistics show that 50 per cent of all persons afflicted with exstrophy are dead by their tenth year, and that 66.67 per cent are dead by their twentieth year. Other defects associated with exstrophy are hydrocephalus, spina bifida, hare-lip, imperforate anus, and epispadias (Figs. 1 and 2). Relaxation and prolapsus of the sphincter ani is often associated and must be excluded before surgical intervention, as their presence is a serious menace to urinary control by rectum. The pubic arch is incomplete anteriorly, and hernia on one or both sides is often an accompanying defect. The umbilicus is lower on the abdomen than is usual, often encroaching on the mucosa of the upper part of the bladder. The deaths are usually due to nephritis which not infrequently accompanies contracture of the lower end of the ureter and thus causes hydro-ureter and hydronephrosis to become pyonephrosis.

The history of surgery as applied to this condition is interesting. Very early the idea of bringing about a cloacal condition such as exists in birds was attempted by transplanting the ureters into the intestines. The first attempt toward this end was made by Simon in 1851. From time to time attempts have been made to form a bladder by plastic procedures. With this type of operation, such names as Roux, Thiersch, Wood, Kanavel, Trendelenburg, Koenig and Albarron are linked.

Maydl, in 1896, transplanted intraperitoneally into the sigmoid the base of the inverted bladder with the attached ureters. Moynihan, in 1906, modified the Maydl operation, making it an extraperitoneal one by transplanting a larger inverted section of the bladder into an opening in the anterior wall of the rectum.

Coffey has demonstrated that the common duct of the liver, like the salivary ducts and ureters, passes through the muscularis and continues for some distance between the mucous membrane and the firmer outer wall of the cavity. Thus pressure from within compresses the ducts and blocks dilatation and ascending infection. It is this principle of Coffey's that has been used in the clinic in recent years. The most satisfactory operation for exstrophy of the bladder, if the ureters are normal, is to unite the right ureter with the rectosigmoid and the left ureter with the upper sigmoid.

The technique generally followed in the clinic today is as follows: A lateral incision, 10 centimeters long, is made and the ureter is located in the pelvis behind the peritoneum (Fig. 3). The definition and location of the ureter are aided by stroking the peritoneum,

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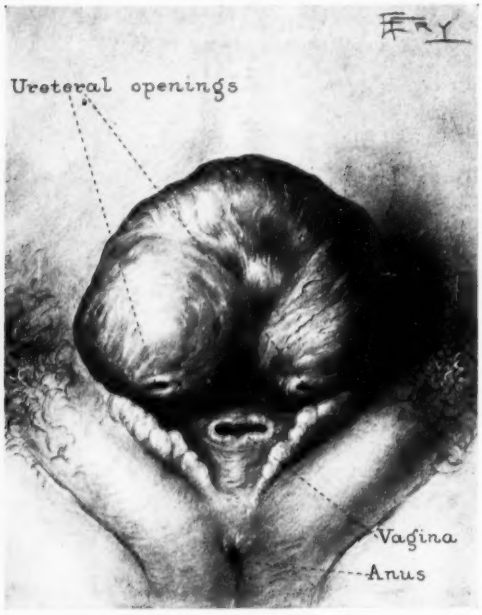

Fig. 1. Exstrophy of the bladder in the female, showing ureteral openings and vagina.

Fig. 2. Exstrophy of bladder in the male. Exposed mucosa with ureteral openings.

as a definite peristaltic wave then becomes visible over the ureter. The peritoneum is incised over the ureter, and the latter is freed and lifted from its bed for a distance of from 5 to 7.5 centimeters. About 2.5 centimeters from the wall of the bladder the ureter is divided between clamps, its lower end is ligated and the peritoneum closed behind the proximal end of the freed ureter. The anastomosis of the right side is made first because of the mobility of the rectosigmoid and the convenience of bringing it to the right lower abdomen without first having transplanted the left side, which would cause tension and limitation of the segment of bowel to be used. At a point opposite the isolated ureter, an incision 3 or 5 centimeters long is made through the serosa, fascia, and muscle of the bowel, in the line of its longitudinal muscles, curving outward at its upper end (Fig. 4). The incision is carried to the mucous membrane with slight lateral separation of the tissues above the mucous membrane to form a trough in which the ureter is to rest longitudinally. At the lower or distal end of the incision a puncture is made in the mucous membrane, large enough to allow the passage of the ureter. The lower end of the freed ureter is split for 0.6 centimeters. A curved needle carrying No. 0 catgut is then passed through the open end and tied to the tip of the ureter. The short end of the catgut is guided into the open end of the ureter for a distance of about 5 to 6.25 centimeters to insure the ureter's remaining patulous during the early days of œdema following its transplantation. The curved needle is passed through the opening into the mucous membrane to emerge 1.25 centimeters below the distal part of the incision in the bowel in the line of the longitudinal bands, drawing the thread with the ureter into the lumen of the bowel. The thread is then fixed and tied in the fold of the intestinal serosa at the point of emergence. Interrupted sutures approximate the divided peritoneum and muscles of the intestine over the ureter, every other stitch catching a bit of the outer wall of the

Fig. 4. The ureter being drawn into the bowel by needle and thread. The thread is advanced into the ureter about 5 or 7.5 centimeters.

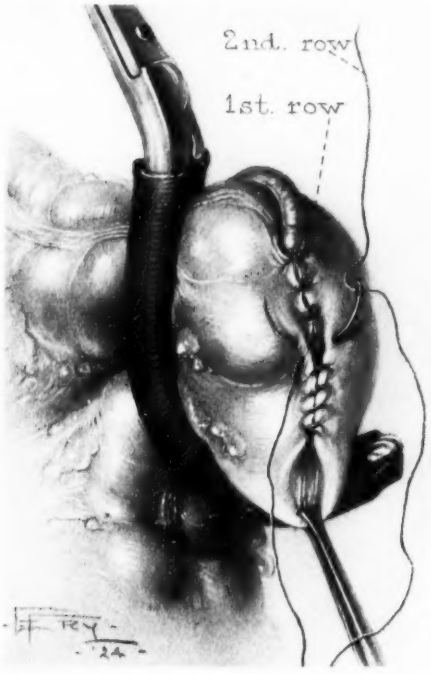

Fig. 5. Closing the muscle and serosa over the ureter.

ureter to fix its position in the longitudinal bed made for it. A continuous row of sutures makes additional protection over the line of the interrupted sutures (Fig. 5). Two or three additional sutures fix the bowel to the parietal peritoneum to cover and avoid kinking of the ureter and to prevent any traction on it. By this method the ureter is incorporated in the bowel wall for a distance of about 2.5 to 3.75 centimeters. Any internal pressure closes the ureter, but does not prevent normal intermittent emptying of the ureter by peristalsis. The second operation, transplantation of the left ureter, is carried out in from 10 to 14 days, which permits sufficient time for the right transplanted ureter to function fully and allows for the interval during which mild symptoms of pyonephritis usually occur.

The most favorable age for the operation for exstrophy of the bladder is between 4 and 10 years. Older persons have been operated on successfully but dilatation of the ureter is more common in them and, if both ureters are dilated, operation is inadvisable. To determine the condition of the ureters before operation, it is sometimes advisable to inject them with sodium bromide and take a roentgenogram. By this means information may be gained which would save unnecessary exploration if they are greatly enlarged. As a palliative measure under these circumstances, meatotomy could be performed on the ureteral orifices presenting at the bladder, to overcome the stricture at this point and to establish better drainage of the ureters.

Recently Coffey described a technique for simultaneous implantation of the right and left ureters into the pelvic colon which does not obstruct the ureters nor disturb renal function (Fig. 6). In this operation tubes are used to transmit the urine through the œdematous bowel tissue surrounding the anastomosis. The left ureter is exposed first and to its proximal end is fastened a rubber tube of very fine bore, and 2 or more feet in length. The thread fastening the tube into the ureter is tied sufficiently tight to control the urine and later to cause sloughing of the tied end. The

Fig. 6. Simultaneous implantation of right and left ureters (Coffey).

right ureter is then exposed and treated likewise.

Then both ureters and tubes are drawn into the lumen of the bowel, through previously prepared incisions in the wall of the latter, and attached to a rectal tube which has been inserted in the rectum at the beginning of the operation. The wall of the bowel is prepared and the closure over the ureter carried out in the manner previously described. The tubes protruding from the rectum are cut to the proper length and placed in a container for the urine. They come away in about a week.

Sixty-six patients with exstrophy of the bladder, observed in the Mayo Clinic from 1901 to April 1, 1926, inclusive, were operated on. Forty-eight of these are living and eighteen are dead. Sixteen patients between the ages of 2 and 6 years are living; six between the ages of 6 and 10 years; seven between 10 and 20 years; thirteen between 20 and 30 years; and six between 30 and 40 years and more, one patient being 40 years and another 73 years. Eight patients died between the ages of 2 and 6 years; one between 6 and 10 years; one between 10 and 20 years; seven between 20 and 30 years; and one between 30 and 40 years.

Thirty-three of the patients living are males, and fifteen are females. Eight of the patients who died were males, and ten were females. Forty-four of the living were single and four were married. Seventeen of those who died were single and one was married.

Forty-four of the patients who are living, and seventeen of those who died had congenital exstrophy of the bladder. Exstrophy followed childbirth in two cases; one patient is living and one died 6 months after a plastic operation on the bladder. Exstrophy followed suprapubic cystostomy in one case in which a plastic closure was made, and the patient is living at the age of 75 years. Total epispadias without sphincter control occurred in seven cases, and total hypospadias without sphincter control occurred in one case.

Fourteen patients were operated on from 1901 to 1915, inclusive, and from January 1, 1916, to April 1, 1926, fifty-two patients were operated on, various types of operations being performed. Plastic operation alone for closure of the bladder was performed in eight cases; transplantation of both ureters in forty-six cases; transplantation of one ureter in nine cases; exploration with closure because of hydro-ureter or hydronephrosis in two cases; transplantation of one ureter to the hepatic flexure in one case; suprapubic cystostomy for excision of carcinoma of the bladder in one case; the Moynihan operation in two cases, and the recent Coffey operation in three cases. In two of these both ureters were transplanted simultaneously, and in the other, one ureter was transplanted.

The mucosa of the bladder was malignant in five cases. Four of these patients are living; their ages vary from 6 to 48 years. Seven patients had been operated on previously in an attempt to remedy the exstrophy or epispadias. In six cases one attempt had been made to perform a plastic operation on the bladder, and in one case five attempts had been made. In one case of epispadias nine attempts had been made to restore the urethra.

Besides the operation for the exstrophy, various other operations were performed at the same time or following it. In one case herniotomy was done at the time of the operation for exstrophy. Nephrostomy for a gangrenous ureter was performed in one case and in one pyelostomy for postoperative acute

obstruction of the ureter. In this group there were two patients with but one kidney. The ureters were transplanted. Both patients are alive. Two patients had hydro-ureter and hydronephrosis. The ureters were not transplanted.

Twenty-nine patients have reported relative to their condition. Twenty-five are satisfied with the results. Two have poor control of urine by rectum. The reports on the control of urine by rectum by day, varied from 2 to 5 hours, and by night from 3 to 8 hours. Some patients did not have to pass urine at night. Others could hold their urine from 2 to 3 hours and from 8 to 10 hours. Only one patient reported incontinence. Bowel movements varied from five to six times a day to once or twice a day. The general health of the patients was invariably good; most of them had gained in weight, had good appetites and slept well.

Six of the twenty-nine patients are living from 1 to 3 years after operation; ten are living from 3 to 6 years; in other words sixteen are living from 1 to 6 years; ten are living from 6 to 12 years, and three are living from 12 to 15 years. Seven of the nineteen patients not heard from were operated on since August, 1925.

Patients who died are classified in two groups: those dying in the hospital and those dying after leaving the clinic. Eleven patients (16.6 per cent) died in the hospital. Their ages varied from 3 to 40 years. Seven were males and four were females. They lived from 2 to 19 days after operation. At necropsy, peritonitis was given as the cause of death in five cases. Pyelitis, pyelonephritis, pyonephrosis, hydro-ureter and hydronephrosis with uræmia were the causes in six cases. Seven patients whose ages varied from 2 to 25 years died after leaving the clinic. They lived from 2 months to 12 years after operation. One patient died from pneumonia; one from typhoid fever; one from metastasis from carcinoma of the bladder; one from nephritis, and one from tuberculosis of the lungs. One patient died 12 years after operation following an accident which occurred during an attack of epilepsy. The cause of one patient's death was not determined.

In one case listed as a hospital death the patient, aged 40 years, had had a plastic operation on the bladder 35 years before. At the Mayo Clinic a piece of tissue was removed for diagnosis from suspicious appearing mucosa of the bladder. The patient died 4 days later of pre-existing pyonephrosis and perinephritic abscess.

From January 1, 1910, to April 1, 1926, twenty-nine patients with advanced exstrophy and epispadias were observed but not operated on because they were too young, because the sphincter and muscles were relaxed and they were unable to control bowel movements, because there was a malignant growth of the bladder, or because they were operated on for conditions other than exstrophy.

The ages of these twenty-nine patients varied from 2 months to 50 years; and six were from 2 to 6 months old; one patient was 8 months; five were from 1 to 3 years; six varied from 3 to 12 years; one was 14 years; eight varied from 20 to 35 years, and two from 35 to 55 years. Twenty-four patients were males and five were females. Twenty-eight were single and one was married. Twenty-five had complete exstrophy and four had partial exstrophy. Twenty-two with epispadias had control of the sphincters. Two of the patients with exstrophy had been operated on twice elsewhere; two had had from two to four operations, and one had had twelve. Two patients with epispadias had been subjected to operation on one or two previous occasions.

Nephrectomy was performed on two patients with exstrophy of the bladder, and nephrolithotomy on one with subsequent perinephritic abscess.

Twelve of the patients with exstrophy were examined from 1910 to 1916, inclusive, and seventeen were examined from 1917 to April 1, 1926. One patient came first in 1912 and returned 14 years later, in 1926, with epithelioma involving the nodes of the groin and the liver.

Eleven patients were too young to be operated on and were told to return later. Six patients had relaxed sphincter ani muscles and involuntary bowel movements, and it was thought inadvisable to operate.

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TREATMENT OF RECURRENT LARYNGEAL NERVE PARALYSIS BY NERVE ANASTOMOSIS[1]

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THE possibility of injury to the recurrent laryngeal nerve during operations on the thyroid gland has always been recognized, and today every surgeon uses well defined methods to prevent the occurrence of this most distressing condition. That the accident may occur, however, in the hands of the most experienced operators is frequently demonstrated; that it should occur much more frequently in operations performed by the "occasional goiter surgeon" is not only true, but is altogether natural.

Paralysis of the recurrent laryngeal nerve implies paralysis of the intrinsic muscles of the larynx, the dilators, constrictors, and tensors. The cord hangs in a flaccid state and narrows the lumen of the larynx by approaching and finally reaching the midline. It is in this stage that dyspnœa becomes acute. Gradually the cord loses its tonus and the glottic chink is again widened. This cadaveric position of the cords is known as "total" or "complete" paralysis. It is in this stage that the voice becomes husky or aphonic. Frequently before this cadaveric stage occurs, and occasionally afterward, there may be no disturbance of phonation, especially when the paralysis is due to pressure, as from an annular thyroid.

Appreciating this fact, we have for several years in the Thyroid Clinic of the University Hospital included in our routine examination, an examination of the larynx previous to operation.

Until comparatively recently, treatment of recurrent laryngeal paralysis was either symptomatic or, at best, palliative. Tracheotomy, either as an heroic effort to prevent suffocation, to relieve or prevent embarrassing dyspnœa, is a well justified procedure. Dilatation of the glottis with bougies, while admittedly of benefit, is transient and requires frequent repetition. Ventriculocordectomy, which implies the removal of all of one vocal cord and the adjacent ventricular floor interior to the vocal process, has been, in the hands of an efficient laryngologist, the operation of choice. This ingenious operation relieves the inspiratory dyspnœa by permitting an adequate exchange of air, but it does not prevent "air waste"—nor does it preserve or restore the power of phonation, the patient for many months being unable to talk above a whisper, although eventually a fairly loud, rough phonation may in favorable cases be obtained. It is, therefore, destructive in character, and limited in its usefulness.

About 3 years ago Dr. Chevalier Jackson, who has seen and treated a great many patients with postoperative laryngeal paralysis, first suggested that some form of constructive operation might be successful. To Dr. Jackson and his associate, Dr. Gabriel Tucker, we are deeply indebted for whatever success the

[1] Read before the American Association for the Study of Goiter, Louisville, Kentucky, February 1, 1926.

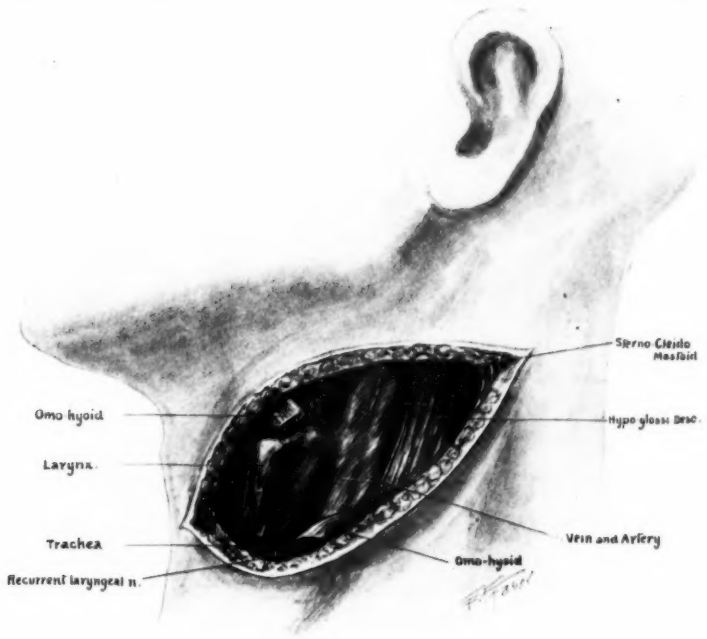

Fig. 1. Incision.

operation may have had. Without their co-operation in the frequent examination of the patients, we would be entirely unable to evaluate the results.

Anastomosis of the proximal portion of one nerve to the peripheral portion of another is, of course, an accepted procedure; its application to the problem of traumatic recurrent laryngeal palsy is one of inference. To Dr. Jackson belongs the credit of first suggesting the feasibility of such an anastomosis; to Dr. Frazier the credit for perfecting the technical procedure.

Both from anatomical and physiological considerations, the descendens hypoglossi nerve (often called the descendens noni) was selected. Situated comparatively close to the recurrent laryngeal nerve, easily accessible as it courses downward on the sheath of the carotid vessels, and of sufficient length to afford transportation without tension, the descendens branch is anatomically ideal. Physiologically it is entirely motor in function, and supplies muscles the action of which is correlated to those of the larynx, thus fulfilling all the requisites of our present knowledge of nerve implantation.

The technical procedure need not be related in detail. It is of interest only to a very few. Suffice it to say that the first step consists in isolating and identifying the stump of the recurrent laryngeal nerve, which may be a long and tedious procedure, because of the presence of cicatrices, the disturbance of normal relations, atrophy, or previous complete avulsion of the nerve. The dissection should begin at the point where the nerve enters the larynx, i.e., at the inferior cornu of the thyroid cartilage. When found, the nerve is then traced downward until its point of severance or constriction is found. Occasionally the injuring force may be due only to scar tissue from which the nerve, after liberation, is found to be intact. In all of our cases, however, actual severance of the nerve had occurred. At this point it is entirely justifiable

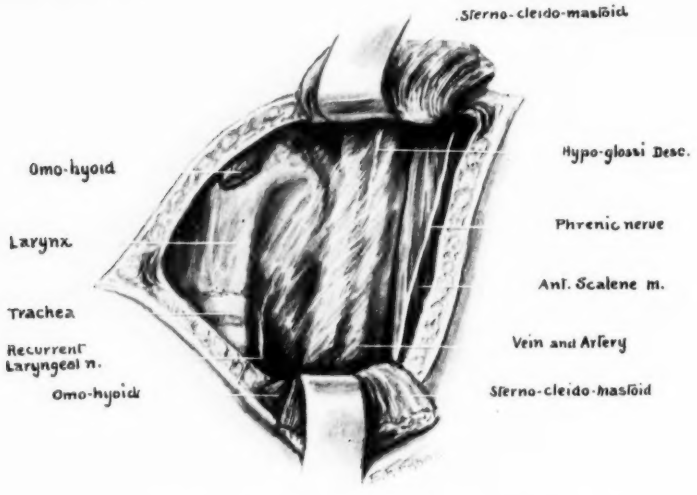

Fig. 2. Exposure of phrenic nerve and of recurrent laryngeal nerve.

to consider end-to-end suture of the divided nerve, but in none of our series was this found feasible, either because of extensive destruction or of retraction of the severed ends. The problem of avoidance of tension is here very important, because of the excursion of the larynx when the patient swallows. Having isolated the recurrent nerve, the operator next isolates the descendens hypoglossi as it courses along the anterior sheath of the carotid artery. It is cut above the ansi hypoglossi, in order partially to preserve nervous innervation of the so-called ribbon muscles, and an end-to-end anastomosis is performed to the previously isolated recurrent nerve at a point, if possible, below its bifurcation. Should paralysis be due to cicatrices an end-to-side anastomosis may be attempted, thus preserving whatever function may still exist in the injured nerve. This is an extremely difficult procedure when we have to deal with very small nerves, and the percentage of failures would probably be proportionately high. In our series only end-to-end suture was performed.

We recognize two chief indications for the operation: (1) to relieve dyspnœa and eventually to dispense with the tracheal cannula; (2) to restore normal phonation.

Since other methods have failed to produce these results, except in a palliative manner, it will probably be generally admitted that any constructive operation which will return function to a paralyzed vocal cord, even in only a very small percentage of cases, or that will partially return function to a larger percentage of cases, is worthy of serious consideration, especially when such an operation is devoid of mortality and does not preclude the subsequent utilization of other methods, if it should fail.

There are certain conditions which if present will prevent success; they are:

1. Complete atrophy and fibrosis of the muscle of the cord. While dependent to some extent on the duration of the paralysis, this condition may occur at any time, and should be carefully looked for.

2. Immobilization of the crico-arytenoid joint which should be tested by attempting passive motions with laryngeal forceps.

3. Tracheal stenosis, which may be due to an ill advised high tracheotomy or to encroachment on the trachea by a substernal goiter.

4. Absence of a segment of the nerve, as a result of complete avulsion at the original operation.

Theoretically, the best results should be obtained when the paralysis has been of comparatively short duration, before the cricoarytenoid articulation has become immobilized, before the stage of complete paralysis has been reached, and before the increasing dyspnœa has necessitated a tracheotomy.

Practically, however, patients seldom come to us until complete paralysis has occurred, and they usually have been wearing a tracheal cannula for a long time. This not only interferes with the ultimate result, but adds another risk to the operation, infection of the wound from the tracheal fistula.

In February, 1923, the first operation was performed; since then nine others have been added to the series. In two of these cases a bilateral operation was performed. In this series I am reporting only those cases in which the paralysis followed thyroidectomy, and I have intentionally excluded all cases in which the operation was performed for other causes. We have had, then, twelve consecutive operations on ten patients. From a technical standpoint two of these were failures, due to the fact that the peripheral end of the severed nerve could not be found. It was thought that in both of these cases the entire peripheral portion of the nerve had been avulsed. At least, in one patient we are relatively certain that this was the case, as she was subjected to two explorations. Not only was the nerve entirely absent, but no vestige of thyroid tissue or capsule could be found. From a technical standpoint, the remaining ten operations were considered successful; that is, the nerve was found and a satisfactory anastomosis performed, as is shown in Table I. With the exception of one wound infection, there were no complications to mar the results.

All of these patients have been, and still are, under careful observation, either by Dr. Tucker or by a laryngologist of known reputation in his immediate vicinity. Various factors have been considered in determining the immediate or ultimate result of the operation. All of these observations were made by departments having no connection with our own, and thus were avoided interpretations which might be influenced by personal enthusiasm. This is important, as all laryngologists are familiar with the varying picture seen through the laryngoscope when the same patient is examined at daily intervals.

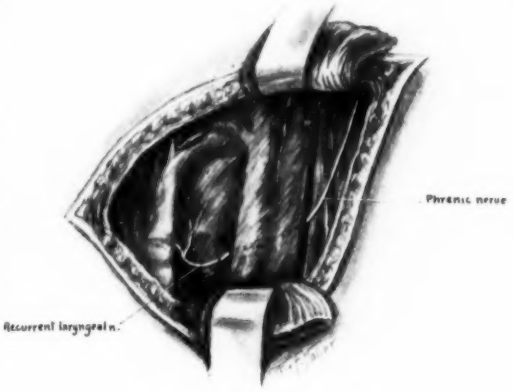

Fig. 3. Anastomosis completed.

Improvement has been judged by relief of dyspnœa, or better phonation, when combined with increased excursion of the vocal cord and arytenoid cartilage as viewed through the laryngoscope. Relief of dyspnœa alone is not an indication of operative improvement, as it is a well known fact that this symptom is normally relieved when the paralyzed cord assumes the cadaveric position. Similarly, changes in phonation may also occur independent of renewed nervous innervation. It is only when such improvement is directly due to return of nervous innervation that we are justified in considering the operative result satisfactory. The degree of improvement is difficult to determine, and is dependent largely upon the condition of the cord previous to operation and the condition of the opposite cord. Varying degrees of improvement can be judged by the ability of the patient to carry on his normal affairs with the cannula corked for increasing daily intervals. Recovery implies freedom of all symptoms, return of the paralyzed cord to normal, and absolute independence of the cannula.

Of the ten technically successful operations, five are at present judged improved, one as recovered, and four as failures. These results are shown in Table II. Two of the results classified as failures represent the present

TABLE I.—ANASTOMOSIS PERFORMED

Case	Diagnosis	Duration	Operation	Technical Result
1	Complete right	6 years	Exploration	Nerve not found
2	Bilateral	6 years	Anastomosis right	Successful
3	Bilateral	11 years	Anastomosis right Anastomosis left	Successful Successful
4	Bilateral	6 years	Anastomosis right Exploration left	Successful Nerve not found
5	Partial right Complete left	2 years	Anastomosis left	Successful
6	Complete right Partial left	2 years	Anastomosis left	Successful
7	Complete right	1½ years	Anastomosis right	Successful
8	Partial right Complete left	3 years	Anastomosis right	Successful
9	Bilateral	8 months	Anastomosis left	Successful
10	Complete left	9 years	Anastomosis left	Successful

condition in a patient in which a bilateral operation was performed, the right side 3 years ago, and the left 2 years ago. The laryngologist's reports on this case are very interesting. Six months after the right-sided operation Dr. Jackson reported that the improvement was remarkable. The posticus muscle was already sufficiently strong to open the glottis to the extent of 3 millimeters. The right arytenoid moved freely, but the cord was motionless. Six months after the second operation he reported that the motility of the arytenoids was quite evident, but that the cords remained flabby and did not abduct. At the last examination, made in May, 1925, the movements of the arytenoids had distinctly diminished, the cords were approximated in the midline, and the patient was dependent entirely upon her cannula for breathing. When it is recalled that this patient's paralysis was of 11 years' duration, the cause of failure is appreciated. The cords had evidently become so atrophic that renewed nervous innervation was a physiological impossibility.

The third failure showed only slight movement 6 months after operation, which has now entirely disappeared. His paralysis was only second in duration to the previously mentioned case. It had existed for 9 years.

These two cases have demonstrated that paralysis of long duration should not be subjected to nerve anastomosis. Six or 7 years is probably the maximum duration from which improvement is to be expected.

The remaining patients have shown constant improvement, as evidenced by return of motion to the intrinsic muscles of the larynx, improvement of phonation, and relief of dyspnœa, as judged by their ability to withstand "corking" or "partial corking" of the cannula. Whether the improvement now present has reached its maximum we are unable to say. Not until a longer period of time has elapsed can definite conclusions be drawn.

Encouraged by the results obtained in this group of patients, the possibility of utilizing other nerves, the innervation of which might more completely return function to the larynx, has constantly been kept in mind. For a long time the possibility of anastomosis with the phrenic nerve has been considered. That the phrenic nerve should be more adaptable to our purpose than the descendens noni is a reasonable supposition, because of the similarity of function of the diaphragm and the larynx. That the phrenic nerve can be sacrificed is a well authenticated fact, as the accessory branches and the intercostal nerves will preserve sufficient innervation of the diaphragm. Experimentally, Ballance has produced successful nervous innervation of the larynx following the operation.

In March, 1925, Dr. Frazier first attempted the procedure, but on account of respiratory distress during the exploration the attempt

was abandoned and the usual anastomosis with the descendens noni was performed. However, just a few days ago (January 22, 1926) a successful anastomosis between the phrenic and the recurrent laryngeal was accomplished. The entire nerve was transplanted. Close observation immediately after severance failed to disclose any evidence of respiratory distress.

Fluoroscopic examination 6 days after operation showed the usual restriction of the diaphragmatic excursion, which had increased about 50 per cent at the end of 17 days, when she was last examined. Laryngoscopic examination made 20 days after operation showed feeble, but unmistakable, movement of the affected cord.

As far as is known, this is the first time the operation has been performed in the human. It is merely mentioned at this time; a detailed report will be published later.

CONCLUSIONS

1. Destructive operations for postoperative recurrent laryngeal paralysis are only palliative in nature and often fail in their purpose.

2. Nerve anastomosis is a constructive operation.

3. Anastomosis of the recurrent laryngeal with the descendens noni branch of the hypoglossal is technically a safe and relatively easy procedure.

4. Our results indicate that improvement is to be expected in at least 60 per cent of cases. The incidence of improvement could probably be increased by confining the operation to patients in whom the duration of paralysis had not exceeded 6 years.

5. Anastomosis with the phrenic nerve has been successfully accomplished.

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TABLE II.—RESULTS OF ANASTOMOSIS

Case	Diagnosis	Operation	Elapsed Time	Present Condition		
				Affected cord	Function	Result
2	Bilateral	Anastomosis right	3 years	Abduction and adduction	Good	Improved
3	Bilateral	Anastomosis right Anastomosis left	3 years 2 years	Immobile Immobile	Poor Poor	Unimproved* Unimproved*
4	Bilateral	Anastomosis right	1 year	Increased motility	Good	Improved
5	Partial right Complete left	Anastomosis left	1½ years	Good motility	Good	Improved
6	Complete right Partial left	Anastomosis left	1 year	Slight motility	Good	Improved
7	Right Paralysis	Anastomosis right	1 year	Good motility	Normal	Recovered
8	Complete left Partial right	Anastomosis right	2 months	Fair motility	Good	Improved
9	Bilateral	Anastomosis left	1 year	No movement	Good	Unimproved
10	Complete left	Anastomosis	9 months	No movement	Fair	Unimproved

*Case 3 showed remarkable improvement 6 months after operation. Later all movement ceased.

THE LYMPHATICS OF THE EXTRAHEPATIC BILIARY PASSAGES[1]

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THE present study has been undertaken to determine whether or not there is a direct lymphatic connection between different parts of the abdomen and the biliary apparatus. Active interest in this question has existed in this laboratory since Graham in 1918 (7), and later with his associates, Peterman and Priest (20), began to emphasize the importance of the lymphatics in the pathogenesis of cholecystitis, hepatitis, etc. Evidence was produced which indicated (1) that hepatitis is a constant accompaniment of cholecystitis, (2) that this hepatitis is most conspicuous in the right lobe of the liver, (3) that cholecystitis frequently represents merely a spread of infection from the liver to the wall of the gall bladder by way of the lymphatics, and (4) that by this explanation it is easy to understand why there exists the frequent association of lesions of the portal system (appendicitis, typhoid fever, peptic ulcer, etc.) with cholecystitis, if one thinks of these portal lesions as producing a hepatitis which spreads to the gall bladder by the lymphatics. These observations have been confirmed subsequently by others. For example, Judd (12) has stated: "A review of our studies inclines us to believe that cholecystitis rarely exists without hepatitis." Likewise MacCarty and Arnold Jackson state that in a series of 58 cases studied with regard to the relationship of hepatitis to cholecystitis, 81 per cent of the cases of cholecystitis showed a chronic inflammation of the liver. More recently also Heyd, Killian, and MacNeal (11) have made similar observations and have also emphasized the importance of the lymphatic origin of cholecystitis.

There are two main sets of hepatic lymphatics: (a) those which pass along in the portal spaces and (b) those which supply the capsule or are superficial. The lymphatics are frequently involved when the portal spaces are affected by morbid processes such as inflammation and tuberculosis, as shown by the enlargement of the lymphatic glands in the portal fissure. Oertel (18) and others have concluded that inflammation may thus spread from the liver to the pancreas or that resolution and sclerosis may result. Oertel further states that in chronic perihepatitis the superficial lymphatics are exclusively affected and that pericholangitis is very closely connected with lymphangitis of the portal spaces; thus the glands in the portal fissure are enlarged in hypertrophic biliary cirrhosis, tuberculosis of the liver, cholangitis and pylephlebitis, all of which are inflammatory lesions involving the tissues and the lymphatics around the bile duct and the portal vein. Braithwaite (2) demonstrated a path of lymph flow from the region of the cæcum to the third part of the duodenum and stated that some of the lymph passes upward over the head of the pancreas to enter the group of glands along the inner border of the second portion of the duodenum. On two occasions the injected fluid passed higher, reaching the glands along the common bile duct and even the gland of the cystic duct.

In order to investigate further the question of the possibilities of a lymphatic connection between different parts of the abdomen and the biliary tract, experiments were carried out which had as their objects the observation of the lymph flow after making various injections of lymphatic vessels. The experiments were conducted on dogs under light ether anæsthesia.

INJECTION OF THE SUBSEROSA OF THE DUODENUM AND OF THE GALL BLADDER

A solution of trypan blue and gelatin (1 gram trypan blue, 5 grams gelatin, water up to 100 cubic centimeters) was slowly injected into the subserosa of the upper part of the duodenum (the first portion), and the colored solution was found to enter the wall of the gall bladder through the lymphatic vessels along the common duct. This observation is particularly interesting as showing the possibility of the spread of infection from a duodenal ulcer

[1]This work was aided by a grant from Edward Mallinckrodt, Jr.

directly to the gall bladder by way of the lymph stream (see injection point *5* on Figure 1).

When, however, the point of injection was either in the middle or the third portion of the duodenum, the dye was found to enter the mesenteric lymph gland which is situated at the beginning of the portal vein after passing through the lymphatic vessels under the peritoneum between the duodenum and the portal vein. These lymphatic vessels pass over the pancreas and do not enter its substance though Bartels stated that they do enter it (see injection points *3*, *2*, and *1* on Figure 1).

If the solution is injected into the lymphatic vessels immediately beneath the serosa of the gall bladder or at the entrance of the portal vein into the liver, the dye is carried to the upper part of the duodenum and to the lymph glands alongside the portal vein. The dye is also seen in the lymphatic vessels on the surface of the right tail of the pancreas and in the lymph gland at the beginning of the portal vein (see injection point *4* on Figure 1). This finding that the lymph drainage from the gall bladder passes over the surface of the pancreas and does not enter its substance, agrees with Archibald's contention and is in disagreement with the findings of Deaver and Sweet (4) and of Graham and Peterman. This relationship occurs in the normal dog. If, however, the gall bladder is adherent to the surface of the pancreas, then a direct anastomosis between the lymphatics of the gall bladder and those of the parenchyma of the pancreas exists. This latter finding may explain the disagreements above noted.

INJECTION OF THE PANCREAS

When the injection is made in the parenchyma of the pancreas, the dye reaches the mesenteric lymph gland located at the beginning of the portal vein, 10 or 20 hours after injection.

INJECTION OF ASCENDING COLON NEAR THE APPENDIX

When the injection is made into the lymphatics of the wall of the beginning of the ascending colon near the appendix the dye reaches the mesenteric lymph gland located at the beginning of the portal vein.

INJECTION OF SMALL INTESTINE

After the injection of the subserous lymphatics of the ileum or jejunum, the dye is seen in various mesenteric lymph glands but not in the one near the portal vein.

INJECTION OF RECTUM

After injection of the subserosa of the rectum, the dye is seen in the lymph gland in front of the sacral promontory but not in the gland near the portal vein.

From the observations above, certain conclusions can be drawn. The lymph which comes from the liver, gall bladder, duodenum, pancreas, and first portion of the ascending colon always drains into the lymph gland which is located at the beginning of the portal vein. On the other hand, the lymph from the rest of the intestine is discharged into the various other mesenteric lymph glands. In the dog there are two large lymph sacs, one of which is called the retroperitoneal lymph sac which occurs in the human only in the embryo. The other sac is the receptaculum chyli. A communication between these two sacs exists in a duct. Thus the two sacs really form one long sac. The retroperitoneal lymph sac is located at the posterior internal surface of the vena cava inferior behind the peritoneum. Some of the efferent vessels from the gland at the beginning of the portal vein drain into the retroperitoneal lymph sac and some of them into the receptaculum chyli. The posterior intercostal lymph vessels of the right side drain into the retroperitoneal lymph sac by anastomosing vessels along the inferior vena cava upward. The lumbar and pelvic lymphatics of the right side also eventually drain into the retroperitoneal lymph sac.

The work of Davis (3), who made a statistical study of the thoracic duct in man, showed that the main lymph vessels of the mesenteric glands enter the cisterna chyli directly, although all the glands possess more or less of an anastomosis between each other. My experiments on the dog give practically the same results, i.e., almost all the mesenteric lymph glands have a direct connection with the

Bartels, P. Ueber die Lymphgefaesse des Pankreas. Arch. f. Anat. u. Entwcklngsgesch., 1906, p. 250

cisterna chyli. The dog, however, differs in that the mesenteric lymph gland which is placed at the beginning of the portal vein always drains into the retroperitoneal lymph sac.

The lymphatics of the gall bladder were first accurately described by Sudler (23) working in Mall's laboratory. He also demonstrated the communication between those of the gall bladder and the intrahepatic lymph vessels. His work has been important in lending evidence to the lymphatic origin of cholecystitis as developed by Graham, Peterman, and Priest (7 and 20). Harer, Hargis, and Van Meter (9) tested the activity of the lymphatic vessels in animals by introducing into the lumen of the gall bladder a hypertonic solution of potassium sulphocyanide, after which the lymph in the subserous lymphatic vessels was collected in fine capillary tubes inserted into those lymphatic vessels. When the lymph so obtained was tested with ferric chloride a Prussian blue reaction occurred. It was already known from the work of Rous and McMaster (22) that the rich lymphatic supply of the gall bladder is probably the means of absorption of fluid during the process of concentration of the bile in the gall bladder. In my own experiments I found that when the trypan blue solution is injected into the subserous lymphatics of the gall bladder, it appears at the upper end of the duodenum, after traversing the lymph vessels along the gall bladder and in the hepatoduodenal and cystoduodenal ligament,[1] and it is found also in lymph glands along the portal vein. Along the portal vein there are usually three lymph glands, of which two are placed on the anterior surface of the vein and one of them posterior to it. The lymph from the right lobe of the liver enters chiefly the gland posterior to the portal vein, but that from the other lobes and from the gall bladder enters the glands anterior to the vein. Almost all of the lymph from these glands passes into the retroperitoneal lymph sac. Not only was it found in my experiments that the lymph stream passes from the gall bladder to the upper part of the duodenum and the glands anterior to the portal vein, but also I found that the lymph channels of the surface and parenchyma of the liver were stained by the dye. The lymphatic vessels on the surface of the liver, especially of the middle lobe, were greatly enlarged and seemed to be completely filled by the colored solution, as were also the perivascular lymphatics slightly beneath the surface of the liver. That these results are not due to the possibility of the transportation of the dye by the blood stream but must be due to lymphatic transportation is shown by the fact that after ligation of the abdominal aorta above the origin of the cœliac axis, the same results can be obtained within 3 or 4 hours after the injection.

[1] In a series of sixteen dogs the cystoduodenal ligament was found to be present in only 23 per cent. The ligament passes from the upper part of the gall bladder to the wall of the upper part of the duodenum above the mouth of the common duct.

EXPERIMENTS TO DETERMINE THE EXCRETION OF SUBSTANCES THROUGH THE WALL OF THE GALL BLADDER

In another series of experiments I attempted to find out whether substances enter the lumen of the gall bladder in any other way than through the cystic duct. The problem, in other words, was to determine whether the gall bladder has an appreciable power of excreting substances. For this purpose various dyes were injected intravenously, after ligation of the cystic duct, and the contents of the gall bladder were examined for them. The substances used were trypan blue, sodium phenoltetrachlorphthalein, and sodium tetrabromphenolphthalein. The dyes were injected after ligation of the cystic duct near the common duct and after a catheter had been placed in the fundus of the gall bladder in order to collect the contents of the gall bladder. Also before the injection, the gall bladder was washed out with physiological saline solution. In some cases it was left empty and in other cases salt solution or some bile was allowed to remain in it. The doses of the different substances used varied from 0.01 to 0.5 gram per kilo. The experiments were, however, practically negative. Traces of trypan blue were found in the contents of the gall bladder 2 hours after the injection when normal gall-bladder bile was allowed to remain in it.

In another series of experiments a gelatin solution was put into the lumen of the gall bladder instead of bile, and 24 hours after the injection the gall bladder was removed. It,

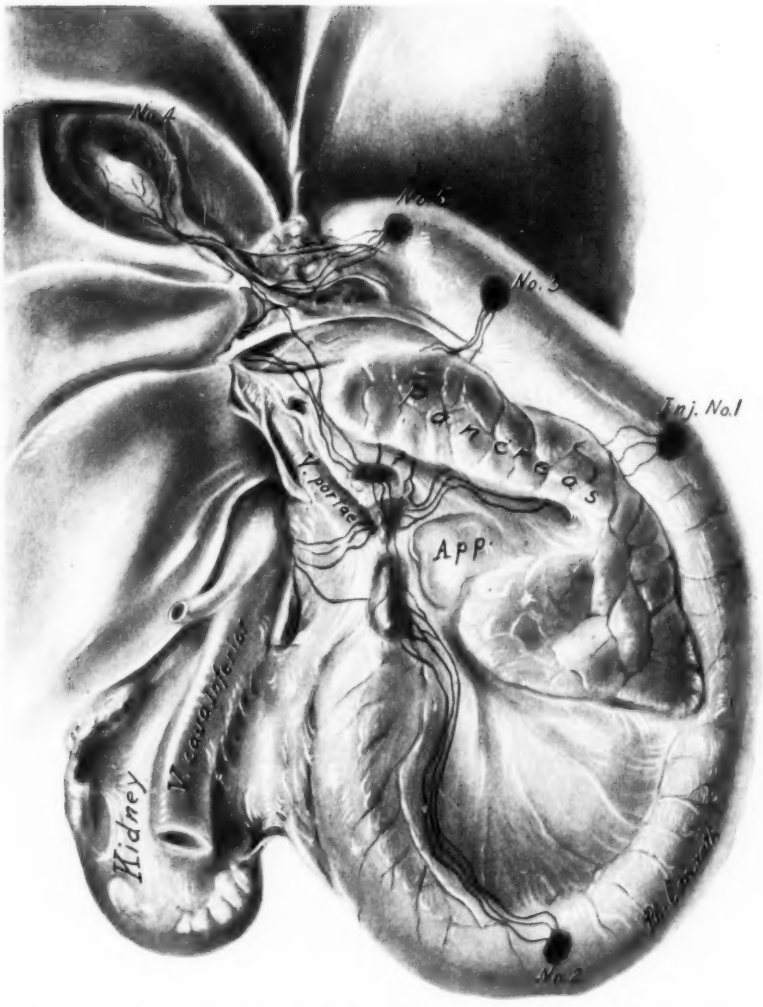

Fig. 1. Distribution of lymphatics about the gall bladder, duodenum, and portal vein in the dog. The duodenum and pancreas have been rotated to the left so that the posterior surface of each is exposed to view. Trypan blue injected into subserosal lymphatics of gall bladder at site *4* passes through lymphatic vessels to the first portion of the duodenum (the ulcer portion) at site *5* and to the glands about the portal vein. Conversely also, when an injection is made at site *5* most of the fluid passes through lymphatic vessels to the gall bladder. The importance of this from the standpoint of the association of cholecystitis and duodenal ulcer is obvious. When subserosal injections are made in the duodenum at sites *3* and *1*, the fluid passes over the pancreas to the lymph nodes about the portal vein. After a subserosal injection of the appendix, which is situated high in the dog, and the pancreas, the dye may be traced in the lymphatics to the nodes about the portal vein.

The Lymphatics of the Extrahepatic Biliary Passages.—Shuichi Kodama.

together with its contents, was placed in an ice box to make the gelatin firm. After removal, the surface of the gelatin was found to be green, thus indicating some excretion of trypan blue into the gelatin. In control cases in which no injection was made, the gelatin was brownish yellow. In another experiment the liver was first washed out with Locke's solution through the hepatic artery. Then gradually a trypan blue and gelatin solution in physiological saline (1 gram trypan blue, 5 grams gelatin, physiological solution up to 100 cubic centimeters) was injected into the hepatic artery after ligation of the cystic duct and vessels. The wall of the gall bladder was stained with the dye and the contents were colored greenish blue, but the amount of dye excreted was too small to be measured quantitatively. Trypan blue was used in fourteen experiments, but in only three was there found an excretion of the dye into the gall bladder. These experiments therefore indicate that, at least as regards trypan blue, there is very little secretion through the wall of the gall bladder.

With the idea that perhaps more secretion would take place if the animal were given an opportunity to recover from the operative trauma before making the injection, the following experiment was performed on a dog. A gall-bladder fistula was created after ligation of the cystic duct, cystic artery and vein, and the dog was then kept for a week after the operation. Trypan blue was then injected intravenously every day in doses of 0.5 gram per day for 3 days. No bile was ever found escaping from the fistula, but the contents were colored blue from the presence of the dye. On the other hand, the contents of the common duct were reddish violet because of the mixture of bile and dye. This finding seems to confirm the idea that there is some excretion of the dye directly through the wall of the gall bladder.

When phenoltetrachlorphthalein was used in a similar way, by means of a gall-bladder fistula after ligation of the cystic duct and vessels, the contents of the gall bladder 2 or 4 hours after injection were brownish red and somewhat resembled coagulated blood. When this material was diluted and shaken with water the color of the solution became scarlet. But when an alkaline solution was added the scarlet color disappeared. For that reason it is impossible to be sure whether the red color was due to excreted dye or to hæmoglobin.

In order to be more certain of the presence of the dyes in the gall bladder under the conditions mentioned above, it was decided to examine the contents with the spectroscope. It was thought that if the special absorption band of the different dyes in the bile could be found, it would prove to be a useful method. But, although pure solutions of the halogenated phenolphthaleins used have sharp absorption bands, it was impossible to find them in the small concentrations in which these substances must be present if excreted through the wall of the gall bladder. Even in the greater concentration in which they are present in the gall bladder when the cystic duct has not been previously ligated, they cannot be found spectroscopically because of the interference of the bile. Thus no special absorption bands could be recognized in solutions of 1 centimeter thickness of 0.001 molecular weight solution of the sodium salt of phenoltetrachlorphthalein. However, in more concentrated solutions special absorption bands were found as follows: 5790A° for tetrabromphenolphthalein, 5890A° for tetraiodophenolphthalein, 5790A° for phenoltetrachlorphthalein. The sodium salts of both tetrabromphenolphthalein and of tetraiodophenolphthalein fluoresce, the former more strongly than the latter.

Abel and Rowntree (1), who first made biological use of phenoltetrachlorphthalein, after it had been prepared originally by Orndorff and Black (19) in 1909, showed that it is excreted from the blood almost entirely by the liver. This dye, however, is excreted to some extent both in the urine and through the intestinal wall even when the direct pathway from the liver to the intestine has been cut off by the establishment of a common duct fistula.

To determine this fact, a glass tube was connected with the common duct; and while the dog was still under anæsthesia an intravenous (jugular vein) injection of the dye was made, after which the contents of the intestine were

collected 2 or 3 hours later. When a solution of sodium hydroxide was added to the collected contents, the color changed from a yellowish gray to pink or violet, the characteristic color reaction of phenoltetrachlorphthalein. In other experiments the small intestine was tied off in several places before making the injection, producing in this way a number of intestinal pouches isolated from each other. In this way it was found that the dye was excreted through the wall of the stomach, the duodenum, and the jejunum. Likewise also it was found to be excreted through the wall of the appendix 4 to 8 hours after the injection.

In experiments in which a common duct fistula was made but in which the intestine was not tied off the stain spread down the whole length of the intestine within 20 hours but disappeared after 48 hours. The excretion through the wall is faster if the injection is not made until about 10 days after establishing the common duct fistula, in other words, after the traumatic effects of the operation have disappeared. If the creation of the fistula is combined with a cholecystectomy, both the rate and the amount of excretion through the intestinal wall seem to be greater.

In order to investigate the possible rôle of the lymphatics in the phenomenon of excretion of the dye through the intestinal wall, other experiments were performed. A cannula was inserted into the abdominal aorta just below the cœliac axis. The aorta was then ligated below this, and the inferior vena cava was doubly ligated and sectioned between the ligatures. The blood vessels of the lower half of the body were then washed out by running physiological salt solution through the cannula. The gastroduodenal and pyloric arteries were ligated, after which a solution of the dye was injected through the hepatic artery. The dye was recognized in the lymphatics of the gall bladder and liver and entered the lymph gland beside the portal vein. From there it ascended toward the duodenum within 2 hours, but it did not actually reach it.

That a solution of trypan blue can pass through the lymphatics in either direction (ascendingly or descendingly) seems probable. For example, when the solution was injected into the efferent lymphatics at the hilus of the portal vein gland, the dye passed in the reverse direction through the lymph sinuses to the peripheral sinus and from there into the afferent lymph vessels. Although there is a direct connection between the lymph sinuses and the peripheral sinus, the flow under normal conditions is from the latter to the former. It was noted also that when, in some dogs, obstructions to the efferent lymphatics from the portal vein gland seemed present, there occurred first an enlargement of the cortex and later of the medulla of the gland, especially after atrophy of the cortex. When an enlargement of the medulla occurred, dilatation of the lymph sinuses and of the peripheral sinus was noted. Incidentally also large numbers of red blood corpuscles were found contained in the lymph sinuses 24 hours after injection of the dye, and the gland resembled in appearance a hæmolymph gland. The evidence of the possibility of a reversal of flow in the lymphatics lends some support to the theory of a lymphatic vicious circle between an inflamed gall bladder and the liver which was advanced by Graham and Peterman in this laboratory.

EXCRETION OF TRYPAN BLUE THROUGH THE GALL-BLADDER WALL

In another series of experiments, intravenous injections of a 1 per cent solution of trypan blue were injected into the jugular veins of dogs. Twenty-four hours later, the gall bladders were removed for histological examination. In one set of dogs, nothing more was done than the intravenous injection. But in another set ligation of the cystic duct, artery, vein, and lymphatic vessels along the duct was performed. The only blood and lymph supply to the gall bladder were the vessels in the attachment of the gall bladder to the liver.

In the former experiments, which served as controls, the following observations were made. In the mucous membrane of the gall bladder, the epithelial cells seemed normal and were not stained by the dye. In the supporting tissue of the villi, however, the dye was recognized here and there. In the muscular coat the thin layer of connective tissue was always stained slightly by the dye. No dye was found in the fibroserous layer.

In the latter experiments, in which ligation of the cystic duct and vessels had been performed, the dye was found in the mucous membrane between the epithelial cells, in the mucus lying free in the lumen and in the stroma of the papilla, but not in the epithelial cells themselves. In the muscular coat there was more staining than in the control animals, especially in the thin layer of dense connective tissue and in the lymphatic vessels which were enlarged sometimes ten or fifteen times greater than normal. In the fibroserous coat, almost all of the lymphatic vessels were enlarged and filled by the contained colored lymph. Even the cytoplasm and nuclei of the connective tissue fibers surrounding the blood vessels were stained also.

In the former experiments, therefore, although the bile in the gall bladder contained much dye the epithelial cells of the mucosa were not stained at all, and in the whole wall of the gall bladder there was very little dye. It was concluded, therefore, that if any dye was absorbed through the mucous membrane of the gall bladder it could not be in large quantity. Moreover, there could not have been much excretion through the gall bladder into the lumen. In the latter experiments, on the contrary, a considerable amount of dye was found all through the wall. This result seemed to indicate very clearly that under the conditions of the experiment, the wall of the gall bladder has a definite excretory function. Perhaps this was due to injury to the gall bladder produced by the ligation of its principal vessels, especially since the gall bladder generally appeared œdematous.

OBSERVATIONS ON THE LYMPHATICS OF THE LIVER

The origin of the lymphatics of the liver was first definitely determined by MacGillavry (16) who studied this subject under the direction of Ludwig. Long before the work of MacGillavry, it had been observed that ligation of the common bile duct was followed by passage of bile over into the lymphatics. From this observation it was but natural to observe the artificial filling of the lymphatics after injecting a colored fluid into the bile duct. Sections of liver in which the lymphatics had been filled with Prussian blue or with asphalt showed that the fluid injected into the bile ducts leaves them at the periphery of the lobule to enter spaces surrounding the blood capillaries, the so-called perivascular lymph spaces. These spaces communicate at the periphery of the lobule, in the center of the portal unit, directly with the interlobular lymph channels. Frequently there is an extravasation of the injection mass into the blood capillaries of the lobule. By a direct injection of Prussian blue into the wall of the portal or hepatic vein it is found that the injected dye enters the center of the portal unit and from there radiates and encircles the blood capillaries. According to Fleischl (6) all the bile is taken up by the lymphatics after ligation of the bile duct, and in case the thoracic duct is also ligated, no bile or only a trace of bile ever reaches the blood. This observation of Fleischl has been confirmed by Kunkel (14), Kufferath (13), and Harley (10). They showed that the perivascular spaces first take up the bile after ligation of the bile duct and they found also that fluids injected into the bile duct pass with ease over into the lymphatics but only with difficulty into the bile capillaries.

Mall (17) found one of the most convenient methods of demonstrating the lymphatics to be the injection of a gelatin solution into the portal vein. In many instances beautiful injections of the lymphatics were obtained from the vein. Also, when the solution was injected into the bile duct, the lymphatics were demonstrated more easily than the finer bile ducts. Rolleston (21) stated that there are two main sets of lymphatics of the liver: (a) those which run along the portal spaces and (b) those which supply the capsule or are superficial. Evans (5) has shown that the typical lymphatic vessel of the liver is accompanied along one or two axes by long arteries and veins which give off a capillary plexus. This capillary plexus is truly adventitial in character, but rests directly on the muscle of the media, in this respect resembling that of the arterial walls.

My own experiments have shown that the capillary walls are very pervious and that the blood plasma passes easily from them out into

the perivascular spaces to bathe the liver cells. It is well known that many of the lymph radicles of the capsules of Glisson, of the larger lymph channels, of the perivascular spaces around the capillaries, and Kupffer's syncytial cells may be filled with the dye. My results, therefore, agree entirely with those described by previous authors. I showed, furthermore, that the lymphatic vessels on the surface of the liver are filled by the dye.

To Prof. Dr. E. A. Graham, I owe my most sincere gratitude, first for his having suggested the idea of my investigating this subject, and then for his expert directions during my work.

CONCLUSIONS

1. The lymphatics of the duodenum and gall bladder are intimately and directly connected.

2. Some of the lymphatic vessels of the liver, gall bladder, duodenum, pancreas, and appendix enter the lymph glands which are located about the portal vein.

3. The lymphatic connection of the liver and gall bladder is made in the parenchyma and capsule of the liver.

4. Phenoltetrachlorphthalein is not normally secreted by the wall of the gall bladder; but it is secreted through the wall of the duodenum and of the jejunum.

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FEMORAL HERNIA; PRINCIPLE AND PROCEDURE

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IN the November, 1925, issue of Surgery, Gynecology and Obstetrics appears a contribution from me entitled "Inguinal Hernia and Operative Procedure." In this I expressed regret at my inability to make more than a passing allusion to femoral hernia, and the present paper is designed to supply that deficiency. I shall also seize the opportunity of commenting on the latest contribution made to this subject by my distinguished friend (and, in this matter, my vigorous opponent and critic) Sir Arthur Keith, in the Mitchell Bruce lecture on the "Origin and Nature of Hernia[1]."

The question is this: Is the femoral sac of developmental origin, and a necessary antecedent of femoral hernia? Or is the sac formed by intra-abdominal pressure outward? In other words, does the sac form first and invite the hernia, or does the hernia make the sac by pushing the peritoneum in front of it?

It is impossible to overestimate the practical importance of finding the correct answer to this question. On the one hand if we recognize that the sac is the necessary antecedent of the hernia, it will render possible the adoption of a standard and uniform method of treatment of extreme simplicity, closely analagous to the simple removal of the sac in oblique inguina hernia. On the other hand, so long as we continue to hold the view that the sac is formed with the hernia, there will be no limit to the operative devices, many of them dangerous, most of them injurious, and all of them uncertain, such as we have seen in abundance in past years and still see.

The clinical features that proclaim the saccular origin of femoral hernia appear definite and unmistakable. I do not propose to repeat here the history of the saccular theory as applied to femoral hernia[2]. I wish merely to state the present position of the subject as it presents itself to me.

[1] Brit. J. Surg., 1923-4, xi, 455-475.
[2] Brit. J. Surg., 1923, ix, November.

The femoral sac is an abnormal constituent of the lower limb, formed by a developmental defect or accident. The lower limb takes its origin at an early period of embryonic life as a limb-bud, and from the first moment of its inception to the last moment of *adult* maturity, it is the seat of progressive developmental change upon which the growth of the limb is dependent. At each moment of existence during a score of years, every constituent of the limb is progressively receding further from the trunk; and for our present purpose we will fix our scrutiny upon the main vessels.

These also must in every part of them be making a slow progress downward; so that a point on the femoral vessels which at birth was immediately opposite to Poupart's ligament will, by the time adult size has been reached, be considerably lower down. We can see certain obvious results of this process in the course of the branches of the femoral artery (Fig. 1). These map out for us the exact nature of the early embryological evolutions far more accurately than the eye of embryological research could ever enable us to see them. This slow descent of the femoral vessels, however, involves another delicate evolution. In the trunk the vessels are in close relation with the peritoneum, but the peritoneum must not accompany the vessels into the limb; it must pull up short at the crural ring, leaving the vessels to travel downward alone, and failure to do this will result in the formation of a femoral sac. Our common Mother will never be found carrying out a delicate evolution of this kind with monotonous infallibility, and she does frequently make femoral sacs in this way. One might have predicted with confidence that she would do so, even had we not observed that she does so. We might also be sure that her errors will not be stereotyped, but certainly subject to gradation and variations.

Femoral sacs vary in size, and their size would appear to be dependent on the length

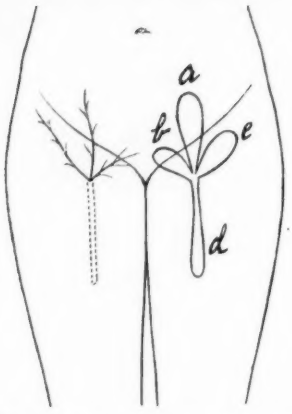

Fig. 1. On the left side are depicted the various positions assumed by large femoral sacs. They are rare: *a* and *b* have been seen by the author once only; *c* more than once in varying degrees; *d*, never. Brief histories of *a* and *b*. *a*, a young woman, duration of hernia 9 years. When she stood up the sac filled with fluid. The sac was removed in 1901; in 1907 there was no sign of recurrence. *b*, a stout man, aged 36. The hernia had been regarded as inguinal and treated with a truss which was, of course, inefficient; the fact that it was femoral was only discovered at the operation, which consisted simply in removal of the sac. This was done in 1902. He died 19 years later. There was no recurrence.

of time during which they are in process of formation. The earlier their start and the longer their period of developmental change, the larger their eventual size. It is convenient for purposes of description to divide them into three classes: large, intermediate, and small.

Class I. Large. These are such as are portrayed in the diagram (Fig. 1). Their distinctive features are (1) rarity; (2) position; (3) size. From these facts it is easy to deduce that they have the earliest possible origin; that their origin synchronizes with the origin of the branches of the femoral artery, and that they assume the identical positions which characterize those arteries because they are subject to the same developmental happenings.

Class II. Intermediate. These furnish the infrequent cases of femoral hernia seen in a children's hospital. They start and form later than Class I, and they consequently are neither so large nor do they assume the same positions. They are rare, but less rare than the larger sacs. Examples of both Class I and Class II would of course be present at birth, but they are too infrequent to make a search for them a rational undertaking.

Class III. Small. These are by far the most common and the question is when and how do they arise. I can see no reason for doubting that their origin is exactly the same as that of the two preceding varieties, and that their smallness is in direct relation with their lateness in appearance. Given the underlying conditions that will be effective in the production of a femoral sac, it is not difficult to understand that at birth they may not have produced a sac that can be detected; and, that being so, there is still plenty of time between birth and adult life for the sac to become evident, more especially at the period of puberty.

Sir Arthur Keith has examined the bodies of 500 infants and has found no trace of a femoral sac in any of them; and he regards this as conclusive evidence that my contention is thereby proved to be mistaken. To this I reply *non sequitur;* the point at issue is whether the sacs found in adults are created by pressure from within the abdomen as he maintains, or whether they are of developmental origin, and a necessary precedent condition to femoral hernia as I maintain. Anyone who has grasped the meaning of the above description that I have offered of the formation of femoral sacs will understand that to examine the bodies of 500 infants would be a hopeless task.

In the search for an example of either Class I or II, 500 bodies would be a wholly inadequate number; it would have been an extraordinary chance had such an example been found. There will then remain Class III and these as we have seen are not necessarily present at birth but make their appearance during the later years of growth between birth and adult maturity.

Therefore the fact that Sir Arthur Keith found no femoral sac in 500 bodies does not seem to be of any significance. I have, however, always felt that although clinical observation is, alone and unaided, abundantly capable of demonstrating the saccular origin of femoral hernia, still it would be interesting

to find out just how much and how little the abdominal pressure is really capable of effecting in the absence of any pre-existing sac in the femoral canal; and this very interesting and important evidence has, it seems to me, been supplied by Sir Arthur Keith himself, who has thereby set the coping-stone upon the edifice of collected facts whereby the saccular origin of femoral hernia is demonstrated. Sir Arthur points out that people who have been subjected to long-continued abdominal strain (he instances people who have suffered from chronic cough) develop little depressions at the femoral and other sites of hernia. I think this must be rather rare, but supposing it to be of frequent occurrence, what does it show? It will show that this is the maximum result in sac-formation that can be got out of the intra-abdominal pressure. This is in itself proof that the femoral sac cannot be formed in that way, because there is neither similarity nor clinical relationship of any kind between these little depressions and femoral hernia or the femoral sac. And this suggests one or two questions, for instance: What proportion of people who have femoral hernia are sufferers from chronic cough; and how is it that such herniæ are seen in young people without cough, and occasionally in children; and why is there no clinical relationship between specially laborious occupations and femoral hernia? Again a rule-of-three sum: If it takes x years of coughing to produce one of these little diverticula, how many years of coughing would be needed to produce one of the large femoral sacs shown in the diagram? And so on. Many such questions will occur to any surgeon who thinks the matter over.

In conclusion, it cannot be too strongly emphasized that the bedside and the operation room are the ultimate tribunal whither the lore of the laboratory and the dissecting room must come for judgment; and forgetfulness of this cardinal principle brings with it dangers to which we are all of us, clinical and research workers alike, peculiarly exposed.

If it is ever to be shown that the saccular theory of hernia is a chimera and a myth, it will have to be done by the study of hernia in the living; by operating surgeons and by them alone. Far be it from me to underestimate the immense value to science and to humanity of the work of so great an anatomist and philosopher as Sir Arthur Keith. But it must be clearly borne in mind that the function of laboratory work is to explain clinical facts, not to contest them; and should a decided conflict of opinion arise between the worker in the laboratory and the worker at the bedside, it would seem in the highest degree unlikely that truth will be found in the laboratory, and error at the bedside and the operation table.

In the early portion of this paper I alluded to a standard and uniform method of operating on femoral hernia, of extreme simplicity, as the natural corollary of the saccular origin of this variety of hernia. Closure and abolition of the sac by separation and firm torsioning from below is in my opinion by far the simplest, safest, and best means of dealing with it. I have already dealt fully with this matter comparatively recently; may I therefore refer any who do me the honor to feel sufficiently interested, to my paper on femoral hernia published in the *British Journal of Surgery*, 1923, xi, No. 41.

CARCINOMA OF THE PROSTATE

A Clinical Study of One Thousand Cases[1]

By HERMON C. BUMPUS, Jr., M.D., F.A.C.S., Rochester, Minnesota
Section on Urology, Mayo Clinic

WHEN a physician has made the diagnosis of carcinoma of the prostate he is usually thoroughly questioned. The patient asks how long he has had the disease, how long he may be expected to live, what form of treatment will give the greatest amount of palliation, what particular type of suffering is likely to occur, and innumerable other questions of a like nature.

It was to answer such questions with a greater degree of accuracy that I reviewed the 1000 cases of carcinoma of the prostate seen at the Mayo Clinic prior to January, 1925. Since the beginning of the use of radium in the treatment of these cases in 1915 careful follow-up records have been kept, and I am therefore able to report complete records in 90 per cent of this series, a number sufficiently large to afford fairly accurate statistical data.

The average ages of these 1,000 patients was 65 years; 495, approximately half, had the disease between the sixtieth and seventieth year; in no case was it encountered before the forty-second year, and in only four did it occur prior to the forty-fifth year. Therefore neoplasm of the prostate occurring prior to the age of 40 should be sarcoma.

SYMPTOMS AND COURSE

Initial symptoms. Accurate determination of the onset of the disease is difficult, since its frequent association with benign hypertrophy makes the symptoms of urinary obstruction unreliable. Frequency and difficulty of urination were given as initial symptoms by 650 patients. It is noteworthy, however, that the next earliest symptom was pain (given by 156 patients). Such pain was undoubtedly ue to metastasis, as it was most common in the back and thighs, and shows how advanced the disease may be before any urinary symptoms occur. Retention, a common first symptom, in cases of benign hypertrophy, occurred in this series but thirty-seven times and gross hæmaturia was never noted as a first symptom.

In 485 cases in which no form of treatment was given, the average duration of the disease from the first symptoms to death was about 31 months. Obviously, then, any form of effective treatment must lengthen this period. When metastasis had occurred at the time of examination, two-thirds of the patients died within 9 months. When careful examination indicated that metastasis had not occurred, the average subsequent length of life was approximately one year, but 58 per cent of the patients succumbed within that time.

In any large series of cases of malignant disease, there are always a few patients who live many years. Thus in this series of untreated cases, there are four patients who lived more than 3 years, two of them more than 10 years. Such cases are usually explained as errors in diagnosis, but when the diagnosis is based on microscopic examination of tissue, this explanation hardly holds. Thus, in one of the cases a malignant metastatic inguinal lymph node was removed 10 years after the initial diagnosis of carcinoma of the prostate, a vivid illustration of the fallacy of attributing to any form of treatment all the favorable results obtained.

Subsequent symptoms. Like the initial symptoms the later symptoms associated with carcinoma of the prostate simulate those of benign hypertrophy. However, the fact that the malignant enlargement soon becomes extracapsular while the benign enlargement does not, is shown by the fewer evidences of obstruction noted in cases of malignant disease. Thus the average quantity of residual urine in this series was but 180 cubic centimeters and the average amount of urea 43 milligrams for each 100 cubic centimeters of blood, almost within normal limits. While the phenolsulphonephthalein readings are not nearly so accurate a test, their average return of 32 per cent in 2

[1] Read before the New York branch of the American Urological Association, New York, October 28, 1925.

Fig. 1. Roentgenogram of a patient who had early metastasis to the sacrum.

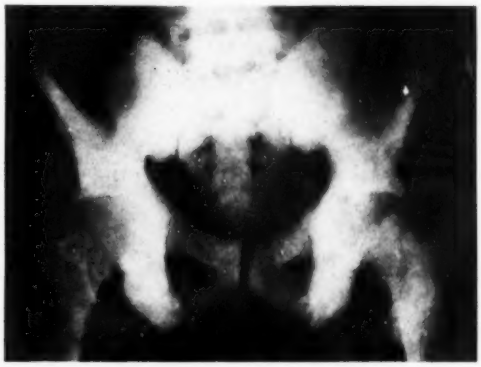

Fig. 2. Extensive metastasis to the pelvis, spine, and femurs, showing increased density and destruction of bone.

hours would be high for a similar number of cases of benign hypertrophy. The microscopic examination of the urine also shows how insignificant are the obstructive symptoms until late in the disease, for in 136 cases it was negative and in only 137 cases was gross hæmaturia noted, while in 362 cases erythrocytes were found on microscopic examination.

Metastasis to the lymphatic system. In 243 of the 1000 cases metastasis was demonstrable. In 44 per cent it had affected the lymphatics. The belief that carcinoma of the prostate does not readily invade the lymphatics is probably the result of a misconception of the true lymphatic drainage of the gland. Unlike the bladder, the prostate is rich in lymphatics which drain directly into lymph nodes situated along the internal and external iliac arteries. These in turn empty into nodes along the sacral promontory which drain into chains of nodes along both sides of the spine. It is evident, therefore, that involvement of the lymphatic system cannot be detected until it has reached the neck. Here the cervical and supraclavicular groups of nodes become involved. When this has occurred the disease must indeed be extensive, and yet in twenty-five patients (11 per cent) metastasis was evident in this situation. Occasionally, if the disease is far advanced, the affected nodes along the iliac vessels and spine become so greatly enlarged as to be palpable. In such cases there is usually marked interference with the lymphatic drainage of the lower extremities, one or both legs being œdematous and brawny. This occurred in 34 cases (15 per cent of the cases of metastasis).

The inguinal nodes were involved in 44 cases (18 per cent of the cases of metastasis). These and the axillary nodes are usually affected late in the disease and are therefore of little diagnostic aid.

Metastasis to the osseous system. While the lymphatic system is without doubt the earliest and most frequent site of metastatic lesions, they are far easier to detect in the osseous tissue, for they are usually of the osteoplastic type, and the increase in the density of the bone renders them discernible by the roentgen-ray. The most common site of involvement is the sacrum (Fig. 1) and adjacent portions of the spine and pelvis. Sproule, who was able to make roentgenograms throughout the entire course of the disease, found that bony metastasis first occurred in this location, after which it spread to the spine and through the pelvis (Fig. 2), finally appearing in the ribs and femurs, and, just prior to death, in the humerus. In this series, 539 patients were examined roentgenographically and the pelvis found involved in 123, the spine in 107, making an aggregate of positive findings in approximately 25 per cent of the series. The femur was affected sixteen times and the ribs ten, but always in conjunction with pelvic involvement (Fig. 3).

Early metastatic lesions are difficult to distinguish from areas of osteitis (Fig. 4) and,

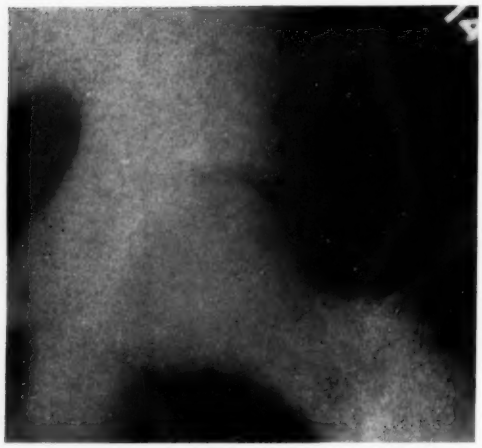

Fig. 3. Metastasis of carcinoma to femur and pelvis, showing increased density with destruction of bone (compare with Fig. 5).

Fig. 4. General osteitis of the pelvic bones easily mistaken for malignant metastasis, but showing increased density in fine radiating lines and no destruction of bone.

when the latter are found in the sacro-iliac region in men of prostatic age, the diagnosis should not be confirmed until careful rectal examination has ruled out the possibility of malignant disease of the prostate. A more frequent cause of confusion in the more advanced cases is the differentiation from Paget's disease (Fig. 5). In the latter, the bodies of the lumbar vertebræ are flattened and widened, and there is increased density without destruction, while with metastasis there is little if any change in the shape of the vertebræ but the increase in density is associated with destruction of tissue. However, as Carman and Carrick have pointed out, there is one means of making the diagnosis certain. "If the skull (Fig. 6) shows the pathognomonic changes of Paget's disease, that is, thickening and density of the inner table and the finely porous outer table with scattered nodules of bone over the vault, the diagnosis of Paget's disease is certain."

Therefore, in all cases of apparent metastasis to the bones in which malignant disease of the prostate has not been clearly demonstrated, roentgenograms of the head should be made before a positive diagnosis is announced.

Metastasis to the lungs. In 246 cases, roentgenograms were made of the lungs (Fig. 7) and in twelve metastatic growths were discernible. In all of these, metastatic tumors were present in the spine or pelvis. Therefore, for diagnosing the presence or absence of metastasis by the roentgen-ray, a plate including the spine, pelvis, and upper femurs would seem all that is necessary.

Metastasis to the spinal cord. Eleven patients had metastasis to the spinal cord which resulted in symptoms simulating tumor of the cord, with more or less paralysis prior to death. Several of these had no urinary symptoms, the pain and paralysis being the initial and sole complaint, the malignant disease of the prostate being discovered during the general physical examination.

At times, even when the cord itself is not affected, the disease in the lymph nodes causes much pressure on the spinal nerve roots with girdle pains and symptoms of sciatica or rheumatism. When such symptoms develop during the age of prostatic disease, the possibility of the pain being due to malignant disease rather than infection must not be overlooked, especially when it is recalled that in this series pain was given as the third most frequent initial symptom, occurring in 15 per cent of the cases.

Metastasis to other parts. Metastasis may affect any part of the body. In this series, the skin, the liver, and the kidneys were affected in several cases.

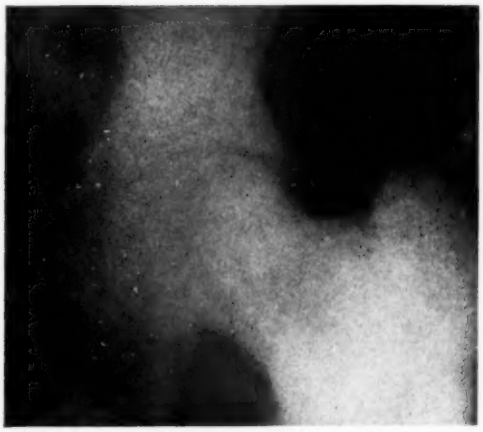

Fig. 5. Paget's disease, showing only increased density of bone.

Fig. 6. Skull in case of Paget's disease, showing thickening and density of the inner table and the finely porous outer table with scattered nodules of bone over the vault, pathognomonic of this disease.

TREATMENT

In the treatment of these patients two problems are encountered: the correction of the obstruction and the treatment of the malignant lesion itself.

Surgical. Of 178 cases in which prostatectomy was performed, there are completed records in 164 (92.1 per cent). In 47 a perineal operation was performed and in 117 a suprapubic. The length of life following operation averaged 30 months for the group, nearly three times as long as when no treatment was given. Thirty-five of these patients are still alive; but half have not lived 3 years; of the 17 others, twelve have lived more than 5 years and may be considered cured. Yet when it is considered that in many of these cases the malignant disease was so recent as to be discovered only at operation after the gland had been removed for supposedly benign hypertrophy, the results are indeed poor, even with the addition of 9 cases in which death occurred more than 5 years after prostatectomy. In all there were 21 five-year cures in 164 cases. This figure should make one hesitate to recommend surgical treatment when the disease has advanced sufficiently to be positively diagnosed.

By radium. Because of these poor surgical results, operation was abandoned at the Mayo Clinic in cases of malignancy of the prostate with the advent of radium treatment in 1915. At first the method of administration of radium was necessarily crude. In 35 cases it was given in the rectum directly over the prostate

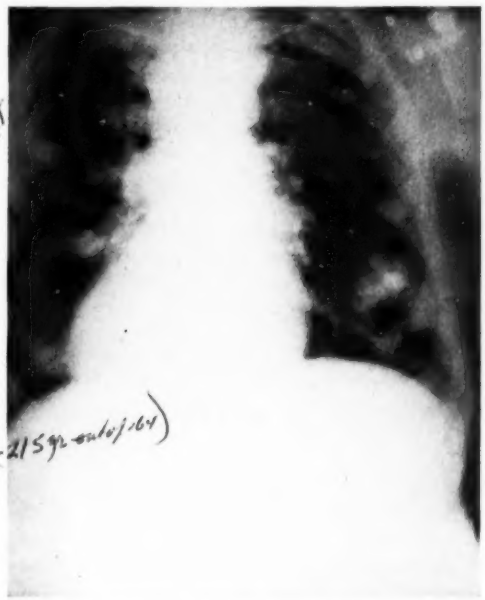

Fig. 7. Metastasis of carcinoma of the prostate to the lungs.

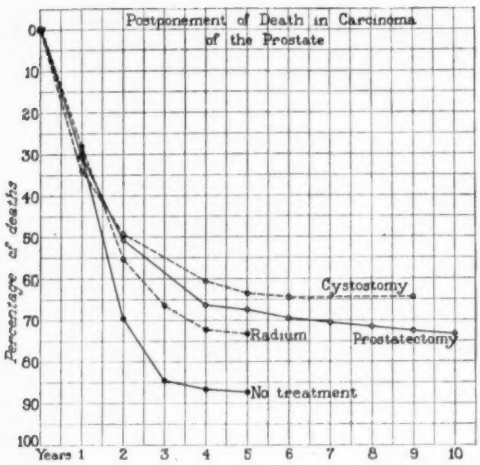

Fig. 8. Postponement of death in carcinoma of the prostate after various procedures.

in an endeavor to irradiate the gland through the rectal mucosa. When it is considered that the amount of radium rays decreases in inverse ratio to the square of the distance, it is apparent how much radium radiation reaches the sensitive rectal mucosa and how little reaches the deeper underlying malignant neoplasm by this method. It is not surprising, therefore, that of the 35 patients so treated, all but one are dead, and that many suffered severely from proctitis as a result of the treatment.

With the introduction of radium-bearing needles by Barringer, the rectal treatment was abandoned and the radium was delivered directly into the growth by needles plunged through the perineum. Thirty-five patients were treated by this method, but only three are alive. The average length of life for the group was 16 months after the application of radium, very little longer than for the patients that received no treatment.

Necropsy in the fatal cases at the clinic showed that the destruction of tissue had been extreme in the neighborhood of the needles, but in other parts of the gland the cancer was unaffected.

If radium treatment was to be successful it was apparent that the gland would have to be irradiated more thoroughly. Therefore, in subsequent cases the radium was applied through the urethra by means of emanation-bearing seeds inserted directly into the gland as well as through the perineum and over the rectal surface. Of the 122 patients so treated there are completed records of 112. The dosage given averaged a little in excess of 2000 milligram hours, and the patients lived an average of 22 months following their treatment. Of these, 25 are still living, 9 more than 3 years, 4 of whom have lived more than 5 years. These results are about equal to those obtained by the surgical treatment, considering that these cases were not as carefully selected. Just as the surgical results did not warrant the continuation of that form of treatment except in selected cases, so the results of radium treatment compelled its abandonment.

By the combined method. In a few cases, prostatectomy was performed following irradiation of the gland with radium. The results were so poor and the technical difficulties of excising a gland previously irradiated so great that it was quickly abandoned. In other cases, radium was given following prostatectomy if the pathological examination showed little involvement. Here I believe is the greatest field of usefulness of radium in connection with malignant disease of the prostate. By the thorough irradiation of the prostatic capsule and seminal vesicle the lymphatic drainage is destroyed and metastasis to the iliac lymph nodes may be prevented if it has not already occurred. Moreover, the resulting scar tissue encases any malignant areas that may remain and tends to keep them localized. If such are discovered, adequate perineal exposure will permit the exact application of many radium-bearing needles or emanation seeds directly into the recurrent neoplasm, which is the surest method of destroying it. Such an exposure makes the neoplasm a surface lesion and, as radium treatment has been successful in proportion to the accessibility of the neoplasm treated, it offers the greatest possibility of cure. Patients so treated, it is hardly necessary to add, should report regularly for examination in order that recurrence may be discovered early.

Treatment of obstruction. If there is but little residual urine, as is usually the case

until late in the disease, the daily use of a catheter to remove it will probably be sufficient to maintain adequate renal function. If the obstruction is more severe and a catheter passes with difficulty, cystostomy is the indicated procedure. This was performed in 125 cases in this series, of which there are complete records of 117. The average duration of the disease was nearly twice as long, being 57 months instead of the usual 30 months for patients who received no treatment. After operation these patients lived an average of 24 months, more than twice as long as the patients for whom cystostomy was not performed. Thirty-four are still alive, 11 more than 3 years since their operation, of whom 6 have lived more than 5 years. These cases may represent mistakes in diagnosis, but error should be no greater in this group than in the group treated with radium. No other form of treatment has proved as free from risk, caused so little suffering, or so lengthened life as suprapubic cystostomy (Fig. 8).

CALCIFIED HYPERNEPHROMA OF THE KIDNEY[1]

Report of a Case Diagnosed by X-Ray Examination; with a Discussion of the Differential Diagnosis of Renal Shadows

By AARON ARKIN, A.M., Ph.D., M.D., Chicago

PROGRESS in X-ray diagnosis of kidney disease has been by very rapid strides since the discovery of pyelography and the development of improved technique in the photography of the kidney. Until recently, however, these roentgenological methods have been employed chiefly for the diagnosis of renal calculus. On this subject a very extensive literature now exists, and it has been found that over fifty conditions other than kidney stones may cause shadows in the kidney region. The fact that so many errors are possible in the roentgenological diagnosis of renal calculus has led to a more careful study of the nature and localization of shadows in the kidney region. The surgeon and the pathologist have disclosed certain diseased conditions of the kidney which can be demonstrated by X-ray examination. These I shall briefly discuss because of their importance in the differential diagnosis of the case of calcified hypernephroma which I wish to report. The various extrarenal shadows which may be confused with kidney stones do not concern us here.

In a study of the roentgen, surgical, and urological literature I have been unable to find a case of calcified hypernephroma of the kidney diagnosed by the X-ray. However, experience with the postmortem examination of a considerable number of hypernephromata, and a review of the literature on the pathology of hypernephroma have led me to believe that this diagnosis will be made in the future. The hypernephroma is a tumor which may be present for years before making itself known to the patient, and during this long course frequently undergoes retrogressive changes such as I shall describe. Calcification, or even metaplasia to bone tissue, is seen quite often in hypernephroma and makes possible a direct demonstration of the tumor in an X-ray photograph, or even with the fluoroscope as in the case which I wish to report.

THE ORIGIN OF HYPERNEPHROMA

There is still much difference of opinion in the literature about the origin of the so-called Grawitz tumor, or hypernephroma, or hypernephroid (Lubarsch). Grawitz came to the conclusion that the tumor originates from misplaced rests of adrenal cortex in the kidney, and this view was accepted by most pathologists. In recent years studies by a number of investigators, and especially by Stoerk, have cast doubt upon the Grawitz theory. Stoerk

[1]From the First Medical Clinic (Prof. K. F. Wenckebach) of the University of Vienna.

Fig. 1. Roentgenogram of calcified hypernephroma of the left kidney, showing compression of the greater curvature of the stomach with hourglass deformity of the stomach.

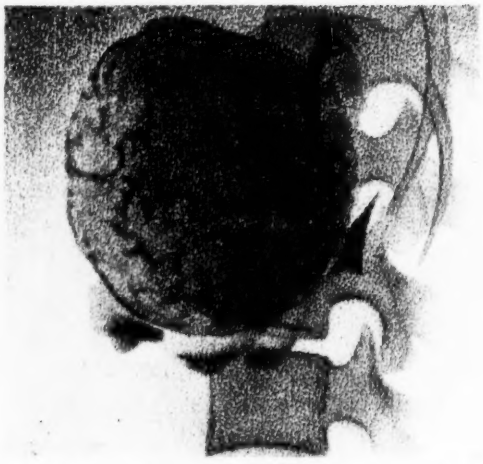

Fig. 2. Roentgenogram of calcified hypernephroma of the left kidney, with pyelogram of the left kidney pelvis filled with sodium bromide solution (side view). The calcified shell and lobulated structure of the tumor can be well seen here, also the marked changes in the renal pelvis.

believes that the hypernephroma is not an adrenal but a renal tumor, originating in kidney tissue. He claims to be able to demonstrate transition stages from small renal adenomata to hypernephroma. For a discussion of this subject I can recommend the new publication on pathology of the kidney by Henke and Lubarsch in their *Handbuch der speziellen Pathologie und Histologie* or Israel's new book on surgery of the kidney.

We find in the kidney quite often simple or benign small hypernephromata which have a characteristic yellowish color and may occur in any part of the kidney, lower as well as upper pole. Then we have the destructive or malignant type of hypernephroma. The structure may resemble the zona fascicularis of the adrenal (typical hypernephroma). These most likely originate from misplaced rests of adrenal cortex in the kidney. There are also atypical hypernephromata of the mixed tubular type which can perhaps be most easily explained as inclusions of kidney tissue in the misplaced adrenal portions. In a certain percentage of malignant atypical hypernephromata it is at present difficult to say what their origin really is. The occurrence of sarcomatous areas in hypernephroma may be considered the result of the presence of mesenchymal tissue in and about the adrenal rests.

If we assume that a large percentage of hypernephromata originates as adrenal rests in the kidney, or even if we accept the renal origin, we in either case are unable to explain the very interesting fact that malignant hypernephroma very rarely occurs in children. It is almost exclusively a disease of middle or old age. Albrecht gives the average age at 48, his youngest patient being 28 years old. Steffen, who collected 228 cases of malignant tumors of the kidney in children, does not mention hypernephroma. Even as late as 1900 Burkhardt stated that no cases of hypernephroma had been reported in children. Franck in 1910 reported one case and was able to find three others in the literature (Bierring and Albert, MacCarty, Clairmont).

The fact that we so frequently find small benign hypernephromata in the kidney postmortem indicates that only a small percentage of these tumors becomes malignant. This transition to malignancy is brought about by unknown factors usually after the fortieth year of life. As we shall see when we discuss the changes occurring in hypernephroma and the long course of the disease in some cases, the disease may, however, cause definite symptoms dating back for years, as long as 40

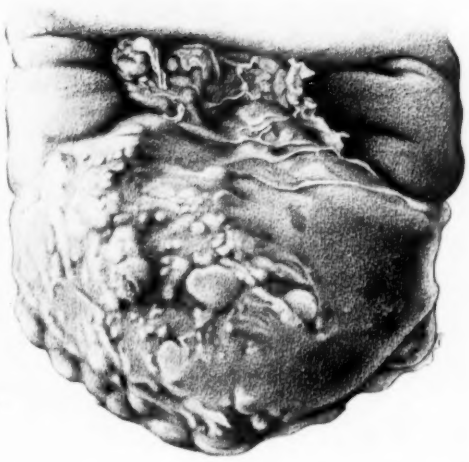

Fig. 3. Drawing showing the surface of the left kidney removed at operation. The nodules of hypernephroma can be well seen projecting beyond the surface of the kidney.

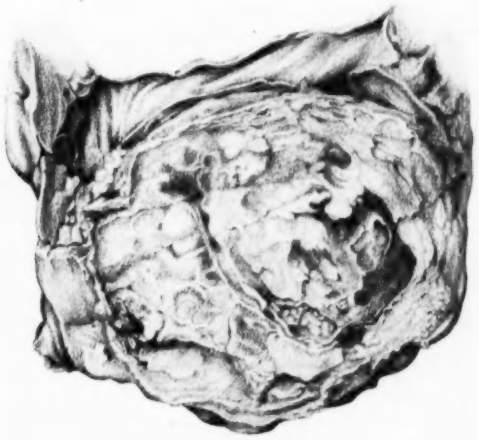

Fig. 4. Cut surface of the left kidney containing the large calcified and partly ossified hypernephroma. The lobulated structure with cystic degeneration and areas of blood pigment deposition can be seen, also the fresh nodules of hypernephroma outside the calcified shell. The compressed and elongated pelvis is seen in the upper part of the drawing.

years. And even after decades of apparent harmlessness the tumor may suddenly become malignant and cause death. This change to malignancy may occur, as in the case reported by me, even after the tumor has undergone very extensive retrogressive changes with calcification and metaplasia to bone tissue. We may conclude then, that hypernephroma is a common tumor of the kidney, which is usually benign and grows very slowly or not at all. It frequently undergoes marked degenerative changes. Yet it is always potentially malignant. This malignancy in hypernephroma is characterized by a marked tendency to invade the renal veins, and produce solitary or multiple metastases, chiefly in the lungs and osseous system.

I wish to call attention to a peculiarity of malignant hypernephroma which is of great importance: It may produce a solitary metastasis in a bone and after removal of such a metastasis the patient may live for many years. The primary tumor in the kidney may be quiescent, yes even unrecognized, and yet a bone metastasis occur. Hence the possibility of hypernephroma should be kept in mind in every case of bone tumor. The early development of bone metastases in a case of tumor of the kidney speaks for hypernephroma. Such metastases have also been seen a long time after the removal of the primary tumor in the kidney. Albrecht reports a case with metastases 10 years after operation for hypernephroma.

SYMPTOMS OF HYPERNEPHROMA

The cardinal symptoms of hypernephroma are hæmaturia, pain, and a palpable tumor of the kidney. In the early stage, or in the benign type, none of these symptoms may be present. We have already called attention to the frequent occurrence in the kidney of small well-encapsulated benign hypernephromata.

Hæmaturia usually results from the invasion of the renal pelvis or one of the calyces by the tumor, and therefore as a rule indicates the malignant character of a hypernephroma. However, hæmaturia very often occurs as the first symptom in hypernephroma, and is usually intermittent. It may be accompanied by attacks of renal colic due to obstruction of the urinary passage by blood coagula. The intervals between the attacks of hæmaturia may be very long, even years. Or the hæmaturia may entirely cease after a few attacks.

Richard Weil has reported a case of hypernephroma in a man of 56 whose first attack of hæmaturia occurred 40 years before operation. Kraft has published a case with a history of 35 years' duration. In the case of calcified hypernephroma reported by me the patient had her first attack of hæmaturia 16 years before she came to the hospital. The fact that hypernephroma can produce hæmaturia years before it causes any other signs of malignancy makes it very important to investigate every case of renal hæmaturia which is not due to nephritis or calculus. We have seen that in some cases the hæmaturia dates back to early youth when a correct diagnosis would enable the surgeon to cure the patient by a nephrectomy. In fact an exploratory operation in a case of one-sided hæmaturia may be in some cases indicated to determine the presence of a hypernephroma.

RETROGRESSIVE CHANGES

Degenerative changes are usually present in hypernephroma. The extent of the changes varies with the size and rate of growth of the tumor. In most large tumors we find areas of necrosis, and hæmorrhage, with deposition of hæmosiderin. The hæmorrhage may be so marked as to cause a rapid increase in the size of the tumor, a not infrequent characteristic of hypernephroma. The patient will state that he suddenly felt a tumor mass in the kidney region which grew rapidly in the course of days or weeks. The tension upon the renal capsule or pressure upon the surrounding structures often gives rise to severe pain. These areas of hæmorrhage may then resorb and leave large pseudo-cysts. When the tumor is medullary in type, that is, contains little connective tissue, then a single large pseudo-cyst may form as a result of necrosis and cystic degeneration. If it is of a scirrhous type, with numerous septa of connective tissue dividing the tumor mass into separate lobules of tumor cells, then the growth may present a variegated appearance on the cut surface. We see masses of yellow or whitish hypernephroma tissue, areas of fresh hæmorrhages, and many small and large cystic cavities lined with a brownish pigment (hæmosiderin) or with organizing blood clots loosely attached to the walls. Some of the cavities produced by necrosis of hypernephroma contain large amounts of cholesterin. The dense connective tissue capsule with its septa extending into the tumor mass may then undergo marked hyaline change, calcification or metaplasia into bone tissue. These changes explain the X-ray picture of hypernephroma in the case which I shall report.

Even with the marked degenerative changes described above, careful histological examination will still reveal areas of hypernephroma and thus enable the correct diagnosis to be made. As examples I shall cite a few interesting cases which I have found in the literature.

Weil in 1908 described a distinct type of hypernephroma which simulates various cystic conditions, and reported one case. The patient, a man of 56, had a large cyst of the kidney which contained a gelatinous fluid rich in cholesterin crystals and blood pigment. The kidney tissue was reduced to a thin shell. The tumor presented the appearance of a hæmatohydronephrosis. Careful examination revealed two small areas of hypernephroma. The patient had had his first attack of hæmaturia 40 years previously, at the age of 16 years. The so-called cyst was a slowly growing hypernephroma with cystic degeneration following hæmorrhage.

It is quite possible that some of the "blood cysts" of the kidney reported in the literature belong here. Two such cases were described by Etcheverry in 1905. Kroenlein and Wyss described a cyst found in the kidney of a woman 37 years old. It was surrounded by a wall of bone tissue and contained only blood clots and cholesterin crystals.

A very interesting case was published by Fabricius. He operated upon a man 55 years old with a cystic tumor of the kidney the size of a child's head. The tumor had a dense sclerotic fibrous capsule and was filled with a reddish-brown fluid which contained some blood clots and cholesterin masses. An examination of the specimen by Professor Ghon revealed a few small rests of hypernephroma cells in the almost completely degenerated tumor. In the connective tissue capsule some calcification and bone tissue formation had

occurred. The patient was reported well 12 years after the operation.

Albrecht in his excellent publication on hypernephroma describes one case (No. 25) with changes similar to those seen in the case reported by me. Had this patient been X-rayed the picture would have very closely resembled the one presented by me. The woman, 58 years old, was in good health until a few months before the operation when she discovered a tumor mass in the left hypochondrium. In the left kidney Albrecht found two tumor masses in the lower pole. The smaller mass, nearer the pelvis, is surounded by a hard fibrous and partly calcified capsule. The larger mass in the lower pole of the kidney is enclosed in a calcified, and in part, ossified capsule. The specimen was sawed in two, as it could not be cut with a knife. The larger cyst is filled with a yellowish to brownish-red mass rich in blood pigment and cholesterin. This tumor was no doubt years or decades old. The smaller tumor mass contained typical hypernephroma areas.

Another case of interest to us is the one described by Kraft under the title "Selbstheilung bei Hypernephrom." I do not consider this title well chosen, because, as we shall see, we can never really consider a hypernephroma "healed." Nevertheless the case illustrates very well the point which I wish to emphasize, and that is: A hypernephroma may undergo very marked degenerative changes over a period of years, remain apparently benign, and calcify or even ossify; it may escape a correct diagnosis unless a careful histological examination is made of various parts of the growth.

Kraft's case of so-called healed hypernephroma occurred in a man of 46 years. At the age of 9 he had some discomfort and pain in the kidney region. At 17 he lost in weight and strength and the pain increased; at this time a diagnosis of Bright's disease was made because of the presence of albuminuria. At 19 the patient had severe pain, with fever and chills and marked hæmaturia and pyuria. After the passage of considerable purulent bloody urine the fever gradually disappeared. Then came severe neuralgic pains radiating from the kidney region toward the bladder and left thigh. Atrophy of the left thigh set in at the age of 23. Between the ages of 24 and 36 the patient had four attacks of hæmaturia and renal colic. In 1916 a diagnosis of polycystic kidney was made with the finding of a nodular tumor in the left kidney region. Operation was performed in 1917.

A large tumor of the upper two-thirds of the left kidney, with two large orange-sized cysts, was found. These contained a reddish-brown fluid and blood clots. The right kidney and the liver were found to be normal. Histological examination of the cysts by Professor Maresch revealed the interesting fact that no epithelial lining was present, hence the nature of the two cysts could not be stated. In 1918 the patient again developed attacks of colic and another tumor mass was palpated in the left kidney region. In 1919 the left kidney was removed. In the upper pole and hilus region a cystic tumor was found. It had a thick capsule and contained many smaller cysts with blood pigment in the walls. Some of the areas were characteristic hypernephroma masses. There were all transitions from lobules of tumor cells to cysts.

From this case we can see that a hypernephroma may be present for 40 years, and undergo such marked degeneration and pseudocyst formation that no tumor cells can be found. Yet it may possess the ablity to recur, with the formation of typical hypernephroma masses after removal of the cysts.

Leopold in 1883 reported a case of huge cyst of the kidney containing 4 liters of a bloody, thick, fluid mass. The cyst had a thick capsule and was sharply separated from the kidney. It contained blood coagula and pigment. This cyst may have been a degenerated hypernephroma. As I have already stated, other cases of blood cyst probably belong in this group. William Israel has also reported a case of hypernephroma with extensive pseudo-cyst formation. While studying the literature on kidney tumor I found one other case which I wish to mention here. Brugnatelli in 1911 reported a case of so-called mixed tumor of the kidney with osteid tissue, which I consider a hypernephroma with metaplasia into bone tissue. The woman of 43 had a tumor of the right kidney which was operated upon.

Brugnatelli describes the tumor as consisting of a main portion of spindle-cell sarcoma, with cells resembling megakaryocytes scattered through it; an epithelial portion with tubular structures and groups of polyhedral cells and a part containing bone tissue. He also found an area of typical hypernephroma.

Unfortunately, none of the above cases was X-rayed, so that we at present have no knowledge of the roentgen findings in these old degenerated hypernephromata. But I think the report of the above cases shows us that hypernephromata may grow very slowly, produce pseudo-cysts, or calcify and even ossify.

Not only may the primary tumor in the kidney undergo these changes, but also the metastases in various parts of the body. A hypernephroma metastasis in a bone may reach a certain size, and then undergo similar pseudo-cystic degeneration or hæmorrhage, and a false diagnosis may result. Albrecht mentions a case in which Kolisko saw in the brain tumor-cysts containing blood. He found them to be hypernephroma metastases, which Neusser had looked upon as brain hæmorrhages. I have seen a similar case of brain pseudo-cysts produced by metastasis from a bronchus carcinoma, which by undergoing cystic softening showed only a very thin layer of carcinoma cells in the wall of the brain cyst.

In metastatic bone tumor it is always necessary to look to the hypernephroma, thyroid, breast, prostate, and bronchus for the primary growth. In a patient with hypernephroma a solitary bone metastasis, or multiple lung or bone metastases, may be the first sign of the existence of the tumor of the kidney. Perhaps we shall be able in some such cases to obtain evidence of the presence of hypernephroma with the X-ray.

THE X-RAY DIAGNOSIS OF HYPERNEPHROMA

The roentgen-ray is of great value in the localization of kidney tumors. For the examination of a case of suspected renal tumor we have several means at our disposal: (1) photography of the kidneys, (2) pyelography, (3) pneumoperitoneum, (4) perirenal injection of oxygen gas (Rosenstein), and (5) examination of the colon and stomach for dislocation (Stierlin).

The X-ray findings in a tumor of the kidney are very variable. A small tumor will as a rule give no positive findings unless it is calcified. On the other hand large tumors may be directly visible in photographs. They are characterized by a more or less irregular or nodular shadow which becomes continuous with the kidney shadow or occupies the kidney region. Tumors of the upper pole are more difficult to demonstrate than those in the lower pole. When the tumor shadow is visible in the X-ray plate then the diagnosis is assured. Occasionally a tumor presents the picture of a stone when it is calcified or when, as in Grosglik's case, a calcified blood clot is present. A number of cases of stone and tumor have been reported (McCormac, Dickinson, Walsham, Israel, Nicolich and Nogues). These have mostly been carcinomata. Perhaps the stone plays the same rôle in carcinoma of the renal pelvis as does cholelithiasis in carcinoma of the gall bladder.

When a tumor grows in the parenchyma of the kidney and toward the renal pelvis, it produces changes in the position, size, and shape of the pyelogram. The calyces may be compressed to form narrow slits or pushed in various directions depending upon the location of the tumor. Or, one or more of the calyces may become distorted or enlarged. The pelvis is sometimes reduced to a narrow slit or divided into isolated recesses. A filling defect may even be visible in the pyelogram.

The entire renal shadow may be enlarged. There may be variations in the density of the shadow. Often the tumor casts a more distinct shadow than the normal kidney. Large kidney tumors may lead to ptosis of the affected kidney.

ROENTGEN FINDINGS IN OTHER KIDNEY DISEASES

The following kidney diseases have been described as producing changes in the roentgenogram: (1) tuberculosis of the kidney, (2) hydronephrosis and pyonephrosis, (3) perinephritis, (4) paranephritic abscess, (5) cystic kidney, (6) calcified blood clot in the pelvis, (7) bilharzia, (8) calcified aneurism of

renal artery, (9) tumors of the kidney, and (10) calculi.

TUBERCULOSIS OF THE KIDNEY

We can differentiate four types of renal tuberculosis from the roentgenological standpoint: (1) tuberculosis of the kidney without X-ray signs, (2) chronic ulcerative or "canal" tuberculosis of the kidney (pelvis, calyces, ureter), (3) cement kidney "*Kitt-niere*," "*Moertel-niere*"), and (4) calcified tuberculosis of the kidney, healing tuberculosis.

In the first type, the early stage of tuberculosis, the X-ray will reveal no changes as a rule. When the renal pelvis and calyces are not yet deformed the pyelogram will also be normal. In such cases of early hæmatogenous tuberculosis the urine will often contain bacilli long before the X-ray findings are positive. In fact, quite extensive tuberculous destruction may occur without roentgenological signs when the renal pelvis and calyces are not markedly destroyed and the tuberculous tissue still has the consistency or density of the normal kidney tissue. When a tendency to heal occurs and calcium is deposited or the caseous mass increases in density then a shadow will be cast. In some cases changes in the bladder or ureter make pyelography impossible.

In the ulcerative form of tuberculosis the pelvis becomes altered in the pyelogram. It is irregular, the calyces are enlarged. The kidney shadow may become enlarged, or, in the advanced stage, smaller due to shrinkage and atrophy. Or the picture may resemble closely that of a hydronephrosis, with a large sacculated pelvis and a lobulated outline of the greatly thinned kidney parenchyma. In such advanced cases in young persons a compensatory enlargement of the unaffected kidney occurs. The roentgen findings in the so-called "*Kitt-niere*" or "*Moertel-niere*" have been described by Oehlecker, Koehler, v. Lichtenberg and Dietlen, Soederlund, and others. In these cases pyelography is often impossible on account of advanced bladder changes or occlusion of the ureter. Characteristic shadows of a hemispherical or clover-leaf shape appear in the kidney. The ureter may be greatly dilated, or appear as a spindle-shaped shadow in the psoas region. There are at times large homogeneous shadows at the kidney poles, with a peripheral darker calcified zone in the cortical region. The X-ray picture may resemble closely a hydronephrosis, looking like a kidney with dilated pelvis and calyces filled with a contrast mass. A plaster-like or doughy mass fills the calyces and pelvis in such cases. The whole urinary canal sytem of the pelvis, calyces, and ureter may be affected, hence the name "canal" tuberculosis. In the advanced stage the entire kidney may consist of a dilated lobulated thickened capsule filled with such a caseous mass. Or the kidney may become shrunken and atrophic. As a rule some calcium deposition is seen in the walls of the large cavities in the form of small spots or stripes in the cortex.

In calcified tuberculosis of the kidney we may have a healing "*Kitt-niere*" or a localized tuberculosis with calcification. Therefore this form of tuberculosis may be mistaken for a renal calculus. I have already stated that the "cement" kidney often contains calcium deposits at the periphery of the masses which have a characteristic hemispheric or clover-leaf shape. The calcium is usually deposited irregularly in spots or stripes increasing toward the periphery. The calcified areas have a less sharp contour than kidney stones and are usually more permeable to the rays. Such cases have been reported by Soederlund, Haudek, Levy-Dorn, Graessner, Dietlen, Holland, Neuhaeuser, and others. I have seen the roentgenogram of such a case, with bilateral involvement.

Soederlund reported 3 cases in which the X-ray photograph enabled him to localize definitely the tuberculous process. Catheterization was impossible in all 3 cases. De Witt reported a case of clinically healed tuberculosis of 15 years' duration in which he could demonstrate three calcified areas in the kidney.

It must not be forgotten, however, that calculus may occur in a tuberculous kidney. A number of such cases has been reported. The differentiation between stone and tuberculosis is as a rule not difficult, though now and then a case occurs in which differentiation is impossible from the X-ray examination

alone. The shadows of tuberculosis are not so sharply outlined as those of stones, the borders are indistinct and often go over gradually into the surroundings. There are often radiary stripes or small spots of calcium at the periphery. The changes also are more marked in the parenchyma of the kidney, whereas stones are usually seen in the pelvis and calyces.

Dietlen and also Noesske reported cases which led to a mistaken diagnosis of stones. In Dietlen's cases there were small sharply outlined shadows in the lower kidney pole. Noesske's case presented shadows in the pelvis region with extensions toward the periphery such as often occur in large calculi.

Graessner has published a very interesting case of tuberculosis of the kidney and ureter, with marked enlargement of the ureter and calcification in both kidney and ureter.

In the calcified form of tuberculosis the prognosis is as a rule better than in the "*Kitt-niere*" (Fenwick) type as the calcification indicates a marked tendency to heal.

HYDRONEPHROSIS AND PYONEPHROSIS

I shall not discuss the characteristic X-ray findings of these conditions but refer the reader to the excellent publications of Baensch and Boeminghaus, Burchard, Dietlen, Eisler, Frank and Glas, Rubaschow and the textbooks on roentgenology. I wish here only to call attention to the possibility of calcification of the kidney in hydronephrosis and pyonephrosis. Such cases have been reported by Goldenberg, Bauer, and others. Goldenberg's case was diagnosed as bilateral nephrolithiasis. Nephrotomy showed hydronephrosis with calcification in the wall of the pelvis and no stones. Bauer's case was one of a large hydronephrotic and partially calcified kidney.

PERINEPHRITIS

Changes in the renal capsule, inflammatory or neoplastic, may produce changes in the X-ray picture of the kidney. Tumors of the kidney capsule, most often fibromata, myomata or mixed tumors, may undergo hyaline change and calcification and produce a definite shadow. I have seen such cases postmortem, but know of none reported in the roentgen literature.

Kraft reported a case presented by Perussia at the Roentgen Congress in Palermo, in which a partial calcification of the renal capsule was diagnosed as a stone in the kidney.

The renal capsule may undergo thickening with connective tissue, or calcification, after a perinephritis or paranephritis and cast a shadow with the X-ray. Rovsing described 4 cases of fibrous perinephritis in patients with uric acid diathesis with a characteristic disease picture. The patients complained of nephralgia, and had occasional hæmaturia during the attacks of pain. The urine was rich in uric acid and urates. Operation revealed a thickened capsula propria with adhesions, and firm fixation of the capsule to the kidney tissue. The capsule was greatly thickened as a result of a sclerosing fibrous perinephritis. Rovsing explains this change as being due to the uric acid, similar to the arthritis urica. More recently Illyès has reported 3 similar cases. He found the same thickened capsule containing uric acid crystals. One case showed with X-ray three irregular shadows in the kidney region due to the capsule changes. Removal of the affected areas of renal capsule gave relief.

Scars in the kidney tissue may cast a shadow (Baetjer, Smart), as may also thickening of the capsule or calcification of the capsule after perinephritis or paranephritis. Koll reported 4 cases of paranephritic abscess with positive X-ray findings. He obtained distinct abnormal shadows in the kidney region, which, together with the clinical symptoms, led to the correct diagnosis in all 4 cases.

Here I might also mention a case reported by Heinecke. A patient with sarcoma of the fibula developed metastases in the perirenal fat tissue of the left kidney. The X-ray gave an irregularly outlined compact dense structureless shadow in the kidney region.

CYSTS OF THE KIDNEY

The X-ray may be of value in the diagnosis of congenital cystic kidney, which is practically always bilateral. Here pneumoperitoneum may aid in determining the size and form of the kidney. The cysts may produce distinct shadows in the X-ray plate, or change the form of the renal pelvis. Haenisch reported a

case of a cyst 6 centimeters in diameter in the upper pole of the kidney of a man of 65. An almost circular sharply outlined shadow of homogeneous density was found by X-ray. Revesz reported a very interesting case of nephrolithiasis with several unusually large round disc-shaped stones, which led to the X-ray diagnosis of echinococcus cysts of the kidney. Kidney cyst may produce a round sharply outlined shadow with a darker border (Barjou). The cyst wall may undergo calcification. Echinococcus cysts rarely occur in the kidney. They may produce a homogeneous sharply outlined round shadow.

ANEURISM OF THE RENAL ARTERY, ETC.

Key and Akerlund have described a case of calcified aneurism of the renal artery. The small aneurism cast a characteristic crescent-shaped shadow in the pelvis region. I might also add here the report of Lotsy on *bilharziosis* diagnosis by the X-ray. He has described the findings in the bladder, and more recently a case of bilharzia of the renal pelvis and ureter. A round shadow with a darker border and two parallel linear shadows running downward from the pelvis toward the ureter was found. Calcification of the adrenal may occur in Addison's disease. Such a case has been reported by Rolleston and Boyet. Such a shadow might be mistaken for a stone. Grosglik has published a case of calcified blood clot in a carcinomatous kidney which gave the roentgen picture of a calculus and was diagnosed as such.

REPORT OF A CASE OF CALCIFIED HYPERNEPHROMA

The case which I wish to report is one of a calcified hypernephroma of the left kidney in a woman of 49 years. The tumor was found by fluoroscopy, and the diagnosis of calcified hypernephroma was made from the X-ray examination and clinical findings. The diagnosis was confirmed at operation.

The patient, M. C., is 49 years old, married. Her father died at the age of 38 of pulmonary tuberculosis. The mother died of a chronic disease, nature unknown. Three brothers and sisters died of tuberculosis between the ages of 6 and 19 years. The patient had measles in childhood. Her menstruation began at 14 and usually lasted 8 days and was profuse but regular. In 1906, at the age of 31, the patient gave birth to her first child, and shortly thereafter developed pain and a dragging sensation in the left kidney region. She was for a time unable to raise her left leg. The physician attributed her trouble to the difficult labor. She was sent to a hospital for a time, and 6 months later the symptoms on the left side subsided after the patient received a special corset for a floating left kidney. In 1909 she had her second child, and shortly thereafter developed two attacks of renal colic on the left side. The first attack lasted 6 hours and was followed by passage of bloody urine. The second attack, which came a few months later, lasted 12 hours and was again followed by marked hæmaturia. In 1911 the patient had her third child.

She felt well from 1909 until 1914, when she developed a right-sided pleurisy. From this she recovered after about 4 months. Since this attack of pleurisy she has had repeated night sweats, often so severe that she has been obliged to change her night-clothes. In 1916 she had a sudden attack of severe pain in the left side while washing clothes. She went to bed immediately. The pain disappeared after a week.

In June, 1923, she had attacks of pain in the right side of the abdomen which usually disappeared in a few hours. At the same time she developed a *feeling of pressure in the stomach after meals.* In September, 1923, she complained of a constant feeling of pressure under the left costal margin in the region of the stomach, and pain in the back on the left side with considerable loss in weight, and hæmaturia.

I saw the patient for the first time at the Wenckebach Clinic on September 4, 1923. She was sent to the roentgen laboratory for a fluoroscopic examination of the stomach. At this examination I knew nothing of the clinical history of the patient. On fluoroscopic examination of the stomach I found a ptotic, somewhat atonic stomach with a peculiar hourglass form. There was no evidence of ulcer or carcinoma. The duodenal bulb was normal. On careful examination of the region of the greater curvature I found a large oval calcified tumor mass in the left hypochondrium. This mass, about the size of a baseball, lay against the greater curvature of the stomach, pushing it toward the right and forward, producing a concavity in the outline of the greater curvature, with the resulting hourglass shaped stomach (Fig. 1). I could palpate the tumor with ease below the left costal margin and found that it moved somewhat with respiration. The lower pole was hard, rounded, and quite freely movable. I was able to distinguish a more dense periphery, forming what looked like a shell about the entire mass. Scattered throughout the entire mass could be seen darker linear and irregularly shaped intense shadows. The whole mass cast a very distinct shadow in contrast to its surroundings. Never having seen such a fluoroscopic picture, and knowing nothing of the clinical history of the patient, my first thought was that I

was dealing here with a calcified tuberculous kidney which was displaced downward on account of its increased weight. We made one X-ray photograph of the abdomen with the woman lying on her back (Fig. 1). This shows what I have already described as evident at the fluoroscopic examination.

Examination of the chest revealed dense shadows in both apices, more in the right than the left. There were also many striped and irregular shadows in both upper lobes. The heart and also the trachea were both displaced to the right. There was also an interlobar linear shadow between the right upper and middle lobes. The right diaphragm stood high and presented several adhesions with obliteration of the right phrenocostal angle. The diagnosis of the chest condition was tuberculosis of both apices with fibrous pleuritis on the right side and fixation of the right diaphragm.

The patient was advised to enter the hospital for examination, but on account of the illness of a member of the family she could not do so. She left for her home in Hohenau, near Vienna. From September 4, 1923, when the X-ray examination was made, until April 10, 1924, we did not see the patient.

On April 10, 1924, she came to the Wenckebach clinic because of loss of weight, weakness, and hæmaturia which had lasted for 6 weeks. *The diagnosis of calcified hypernephroma with hæmaturia was then made.*

Examination. The patient is a woman of medium size, with very little subcutaneous fat. There is no œdema of the skin, no abnormal pigmentation. The mouth mucosa is normal. Temperature is 37 degrees C. and respiration 20 per minute. The patient weighs 45 kilos.

The radial arteries are somewhat rigid. The blood pressure is 105 Riva Rocci. The pulse rate is 84 and regular. The pupils are equal in size and react normally to light and accommodation. The eye movements are normal. The tongue is moist and shows a fine tremor; it is not coated. The pharynx is normal. The thyroid is not enlarged. There are no enlarged glands in the neck, axilla, or inguinal regions. Percussion reveals dulness of both apices of the lung, the right more than the left. Moist râles are heard over the right apex. The breath sounds are somewhat weaker over the right lung. Bronchial breathing is heard in the region of the left apex. Vocal fremitus is increased over the right lower lobe. There is dulness on the right side of the chest beginning at the level of the third rib in front and extending in a curved line to the eighth spine behind.

The apex beat is in the fifth intercostal space, inside the mid-clavicular line, and only palpable when the patient lies on her left side. The heart is not enlarged. The heart sounds are normal.

The abdominal wall is relaxed. There is no ascites, no meteorism. Below the left costal margin a fist-sized tumor of very hard consistency is palpable. It can be distinctly felt over its anterior surface and lower pole and can be grasped by the fingers. It is separable from the spleen. The tumor is not painful. There is marked dulness on percussion in the tumor area. The liver is not enlarged. The spleen is normal in size. Abdominal reflexes are normal.

April 11, 1924. Urine. Color reddish, cloudy, reaction weakly acid. Albumin is positive. Sugar negative. Acetone and aceto-acetic acid negative. Chlorides are not reduced. Positive blood reaction. Specific gravity 1,020 to 1,032. The sediment is rich in red blood cells and leucocytes.

April 12, 1924. Cystoscopy by Dr. Zinner. The urinary bladder is normal except for a slight chronic inflammation of the neck of the bladder. Both ureteral orifices appear normal. The right ureter yields an absolutely clear urine free from blood. Catheterization of the left ureter is made without any difficulty. No resistance is met and the catheter is passed 25 centimeters. Only a few cubic centimeters of bloody urine is obtained from the left kidney, then the catheter becomes obstructed by blood. Indigocarmine given intravenously gives a distinct green coloration of urine on the right side in 3.5 minutes, on the left side in 5 minutes.

Report of cystoscopy reads: Left-sided hæmaturia with rather good kidney function.

April 16, 1924. Pyelography. Fifteen cubic centimeters of sodium bromide solution passes readily into the left kidney pelvis. The injection is controlled under the X-ray screen. The fluid is visible as a compact mass in the lower medial circumference of the tumor. A photograph with the patient lying on the right side shows that on the inner circumference of the tumor, ventral and basal to it, is a large calyx filled with bromide solution. The rest of the pelvis is not visible, which speaks for projection of the tumor mass into the renal pelvis.

With postero-anterior fluoroscopy one sees that the renal pelvis is irregular and not sharply outlined, in the lower and median portion of the calcified tumor, and partly overlapping its borders. A lateral view shows the shadow to be made up of five distinct and separate bromide depots, which represent the filled portions of the deformed pelvis. Two of them lie on the anterior lower circumference of the tumor, one on the posterior circumference. The distance of these depots from the tumor is only about 1 to 2 millimeters. Two other depots lie about 1 centimeter below the lower pole of the tumor. The renal pelvis is therefore pushed downward by the tumor, spread out flat in a plane almost at right angles to its normal long axis. The tumor itself is sharply outlined and oval in shape (Fig. 2).

The patient was operated upon in the Policlinic Hospital (Prof. Rubritius) on April 18, 1924, by Assistant Dozent Dr. Schwarz, to whom I am grateful for the following report of the operation:

A lumbar incision was made. After the fascia and musculature had been incised, the strongly vascularized, rather thin, fatty capsule of the kidney was visible. Through this the kidney and tumor could be seen. After the fatty capsule, which was adherent to the anterior surface of the kidney pelvis, had been opened, the lower pole of the tumor was freely mov-

able. The ureter was ligated with double ligatures and cut. As the kidney extended high up under the costal margin the twelfth rib was resected in order to free the upper pole. Then the kidney was lifted out *in toto*. The hilus region was prepared, the greatly dilated renal vein ligated, also the renal artery. A mass ligature was then placed about the pedicle and the tumor and kidney removed. The bleeding from the fat capsule was controlled, a drain placed in the wound and closed. At 5 o'clock the pulse was 108. The bandages were somewhat saturated with blood. Spontaneous urination occurred that evening. On April 23 the drain was removed. On May 5 the patient left the Policlinic Hospital for home.

Examination of the tumor was made by Prof. C. Sternberg, pathologist to the Policlinic Hospital, and by myself.

The kidney is of triangular form, with a length of 16 centimeters, width of 11 centimeters, and thickness of 9 centimeters. It presents at both poles and on the side corresponding to the renal pelvis, a smooth reddish-brown-colored surface, whereas on the remainder of the surface it is nodular, and of a whitish-yellow color with reddish stripes and spots scattered throughout (Fig. 3). The capsule of the kidney is thickened and is especially difficult to remove in the last-mentioned areas. In the reddish-brown areas the tissue is of a doughy soft consistency, whereas the rest of the mass is very hard. The tumor cannot be cut with a knife because of the hardness due to calcification. It is 10 centimeters long, 9 centimeters wide, and 10.5 centimeters in the antero-posterior diameter. It is cut into two halves with a saw. On cut section the reddish-brown areas are rests of kidney parenchyma in which the cortex and medulla are greatly thinned, with indistinct markings. From this tissue the previously described whitish-yellow tissue spreads out with unsharp outline over large portions of the cut surface of the tumor. The whole tumor mass is elliptical in shape and surrounded by a thick capsule of connective tissue containing calcium deposits and in several places also bone tissue. Penetrating into the tumor mass from the shell-like capsule are numerous dense calcified or bony-hard septa and lamellæ. These divide the tumor into numerous round or oval areas. Some of these contain blood coagula and pigment. Others contain white necrotic masses. Near the periphery there are yellow areas of tumor tissue. The renal pelvis is deformed, the mucosa thickened and hyperæmic. The kidney pelvis is compressed by the tumor mass so that it forms an irregular elongated narrowed cavity, which is pushed medianward and downward by the tumor mass (Fig. 4). Histological examination reveals typical hypernephroma areas, with areas of necrosis and hæmorrhage. In some of the lobules cystic degeneration has occurred. In others blood pigment is present in considerable amount. The capsule and some of the calcified septa contain in various places irregular masses of bone tissue. The renal veins are entirely free from hypernephroma.

On July 30, 1924, the patient returned to the Policlinic complaining of pain in the back. The urine was clear. To the left of the spine and adherent to it a fist-sized tumor mass could be felt in the abdomen. There is a recurrence of the hypernephroma at the site of the tumor.

On September 13, 1924, the patient again came to the Hospital complaining of severe pain on the right and also left side of the abdomen. She had lost considerable weight and had very severe pain on walking. She appeared subicteric. In the left hypochondrium near the umbilicus was a dense fist-sized tumor. The right kidney lay low and was movable. The patient left the hospital October 8, 1924.

In a study of the literature I have not been able to find a case of calcified hypernephroma which was diagnosed by X-ray examination. The hypernephroma described in the above case does not differ greatly in its pathological anatomy from a number of specimens described in the literature, nor from several which I have seen in the autopsy room. The retrogressive changes in this case are characterized by marked calcification of the capsule of the tumor forming a hard shell. The shell is from 1 to 4 millimeters thick, and in some areas has the consistency of bone tissue. Parts of the capsule have remained uncalcified and consist of a dense hyaline connective tissue. In the capsule and also in several septa of connective tissue within the tumor mass bone tissue was found. The tumor is divided into many lobules of hypernephroma tissue in various stages of necrosis. Some areas are distinctly yellow, others yellowish-white; and in many places cystic degeneration can be seen, with hæmorrhage and pigmentation (Fig. 4).

These changes explain very well the X-ray photographs of the tumor mass. The X-ray pictures of the tumor taken before operation, and one of the tumor mass after extirpation of the kidney present the following findings:

Surrounding the entire elliptical tumor shadow is a distinctly calcified shell varying in thickness from 1 to 4 millimeters. This shell consists of linear and punctiform shadows, interrupted from place to place by areas of the capsule which contain little calcium. Throughout the entire tumor mass are distinct and indistinct irregular small shadows of calcification, which assume a definite arrangement in many parts of the mass. The shadows form

round or oval areas containing less distinct spots and small irregular calcium deposits. These give the tumor a lobulated appearance, forming a network of calcified masses separating small and large clearer spaces (Figs. 1 and 2).

This X-ray picture is characteristic of a tumor of the kidney of slow growth rich in connective tissue, that is, a tumor of the scirrhous type. Had the tumor been of the medullary type we would have found in the X-ray photograph the thick calcified shell without the lobulated appearance throughout the tumor mass. The calcium deposits in the connective tissue of the tumor have produced superimposed shadows throughout the tumor mass but with a distinct lobular appearance, due to a more marked thickening and calcification of some connective tissue septa than of others.

This picture differentiates itself at once from that of other diseases of the kidney which produce distinct X-ray shadows, and which I have described above. In the tuberculous kidney we never see so sharply outlined and spherical a mass, the calcification is usually at the periphery and lacks the lobulated structure seen here. Furthermore the pyelogram (Fig. 2) in my case is characteristic of a tumor mass compressing, dislocating, and deforming the pelvis and calyces. Such a pyelogram rules out tuberculosis. A cyst of the kidney (echinococcus, etc.) with a smooth interior does not produce such a shadow, lacks the lobulated structure and has a capsule of more uniform thickness and density.

The X-ray picture described is characteristic of a slowly growing, hence calcified, kidney tumor with a lobulated structure, and therefore of hypernephroma. Perhaps an adenoma of the kidney of so large a size could produce a similar picture, or some other form of renal tumor. However, the characteristic X-ray picture, the typical pyelogram, and the clinical findings enabled us to make a diagnosis of calcified hypernephroma in this case.

From a study of the pathology of hypernephroma I am inclined to believe that similar X-ray pictures in hypernephroma will be found if these cases are photographed more often; and that a roentgenologist who is acquainted with this picture will be able to make a diagnosis of tumor of the kidney (most likely hypernephroma) from the photograph alone.

SUMMARY

Hypernephroma is a not uncommon tumor of the kidney found quite frequently on postmortem examination. Most hypernephromata probably originate, as Grawitz believed, from misplaced adrenal rests. Malignant hypernephroma rarely occurs in children. It may remain benign for years and then assume malignant characteristics. Cases are reported in the literature with a duration as long as 40 years.

Malignant hypernephroma is characterized by a special tendency to invade the renal vein and produce metastases in the osseous system and lungs. A solitary metastasis is no contraindication to operation, for its removal together with the primary growth may result in cure, or years of good health.

The slow growth of some hypernephromata is accompanied by marked degenerative changes, with pseudo-cyst formation, hæmorrhages and pigmentation, hyaline changes, calcification, and even metaplasia to bone tissue. Some of the so-called cysts of the kidney are degenerated hypernephromata.

Hæmaturia may be the first symptom of hypernephroma, and may be present as long as 40 years. Every case of hæmaturia in a person past middle life should suggest the possibility of hypernephroma when no other cause for the hæmaturia can be found.

The X-ray is of considerable value in the diagnosis of kidney tumor, and in its differentiation from other renal diseases which produce kidney shadows such as tuberculosis, cyst, etc.

A case of calcified and partly ossified hypernephroma of the left kidney producing gastric symptoms in a woman 46 years old is reported. It is of special interest because of its long duration (16 years) and the striking X-ray findings. It was found on fluoroscopic examination of the stomach which presented an hourglass deformity. The X-ray picture reveals a distinct calcified capsule and a definite lobulated structure characteristic of a slowly growing renal tumor of

the scirrhous type. A number of similar cases have been described in the literature, but this is the first case in which diagnosis was made by X-ray during life. A knowledge of the X-ray picture in this case will enable the roentgenologist and urologist to diagnose calcified hypernephroma in the future.

Removal of the calcified hypernephroma by nephrectomy was followed by a recurrence at the site of the tumor. The diagnosis of hypernephroma was confirmed by histological examination.

I wish to thank Dozent Dr. Karl Hitzenberger, roentgenologist, for the opportunity of studying this case.

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IODIZED OIL AS A PYELOGRAPHIC MEDIUM[1]

With a Report of 27 Cases

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THE results of an experimental study of the use of iodized oil as a pyelographic medium have been given in a preliminary report (4). The purpose of this paper is to present further experimental data together with the results of its use in the clinic in 27 cases. The solution used in the previous experimental work consisted of a 40 per cent iodized oil.[2] The solution employed in the clinic, consisted of an emulsion of 90 parts of the 40 per cent iodized oil, with 10 parts of a neutral soap solution. The soap solution was added because it was found that the original solution flowed with some difficulty through small ureteral catheters. The slight decrease in the opacity of the emulsion was found to be negligible.

In the year 1897, Winternitz (7) described a method of preparing iodized oil using an animal fat. He (8) fed this solution to certain animals and found that the iodine was absorbed from the gastro-intestinal tract. Since that time iodized oil has been used for the therapeutic effect of the iodine and has been given to both experimental animals and human subjects with no untoward results. Iodized oil at the present time is available under the commercial names of lipiodol, iodoleine, and iodipin 40 per cent.

The first preparation is a French product of carnation oil in chemical combination with iodine to the amount of 0.54 gram per cubic centimeter. The second is a very similar French product of poppy seed oil with approximately 30 per cent of iodine. The third is a German product of sesame oil in chemical combination with iodine to the amount of 0.51 gram per cubic centimeter.

Although the combination of iodine with the various unsaturated fats used in the above products is organic and the resulting product quite inert, the decomposition products might prove irritating and toxic. It is, therefore, advisable not to heat the above preparations for sterilization or to expose them to light for long periods.

Forestier and Sicard (1) in 1922, first demonstrated the value of iodized oil as a contrast medium in roentgenography. Iodized oil has been used by these authors (2) as well as by many other European workers (6) for intratracheal injections and for the localization of spinal cord lesions. Russell (5) has likewise reported its use in an American clinic. It has been generally reported that the solution is relatively impervious to the roentgen rays and only slight reactions have been observed. It has been found that the solution when injected into the spinal canal remains for many months before absorption takes place and causes very little if any reaction.

EXPERIMENTAL STUDY

Before we used this opaque medium in the clinic it seemed advisable to answer the following questions by animal experimentation:

1. Does the iodized oil give an appreciably better shadow than a sodium iodide solution in pyelography?

Taking a 12.5 per cent solution of sodium iodide, which is the concentration generally employed, a comparison of the opacity of this solution with that of 40 per cent iodized oil is obtained by comparing the iodine concentration since it is upon this that the opacity depends. The ratio of the iodine content of the sodium iodide and the emulsified iodized oil is approximately 1 to 3.

An actual comparison was presented in a preliminary report (4) of cases in which equal amounts of both solutions were injected for pyelograms under similar conditions. A study of this comparison leaves little doubt as to the desirability of a more opaque medium than that of 12.5 per cent sodium iodide.

[1] Abridgment of thesis submitted to the Faculty of the Graduate School of Yale University in partial fulfillment of the requirements for the degree of Master of Science in Surgery, May, 1925.

[2] Iodipin 40 per cent (Merck).

[1] Presented before the Clinical Congress of the American College of Surgeons, New England Section, March 27, 1925.

Figure 1 is the film of a bilateral pyelogram in which iodized oil was used in a dog in which an experimental ureteral infection[1] had been produced and resulted in a right pyonephrosis, hydro-ureter, and multiple ureteral strictures. The left ureteral shadow which represents less than 2 cubic centimeters of iodized oil is plainly outlined upon the vertebrae.

2. Has iodized oil any irritative action upon the urinary tract?

A series of 18 pyelograms, 8 of which were bilateral, were made upon healthy dogs, iodized oil being used. The animals were followed for periods varying from 10 days to 4 months, and in each case there were no symptoms observed which were attributable to toxicity or irritation of the urinary tract. One animal known to have complete destruction of the right kidney, likewise showed no untoward symptoms following bilateral pyelography (Fig. 1).

3. If the iodized oil was accidentally forced into the circulation by the pyelo-venous route (3), what would be the effect?

The following experiments were done to determine the results of such an accident: For these experiments 6 normal dogs were chosen. Dogs 1 and 2 received 10 cubic centimeters of 40 per cent iodized oil intravenously; 3 and 4 each received 12 cubic centimeters and 5 and 6 each received 14 cubic centimeters. Roentgen-ray plates of the abdomen and chest were taken 5 and 10 minutes and 24 hours following the injection and no evidence of the oil was seen upon the roentgen-ray films. Animal 1 was killed 48 hours following the injection. Grossly the lungs showed multiple hæmorrhagic areas throughout, bright red in color, and varying in size from 2 millimeters to 2 centimeters. Microscopic examination of these areas showed groups of collapsed alveoli, engorgement of the capillary vessels, and infiltration of the alveoli, with red cells and mononuclear and polymorphonuclear leucocytes. After staining with Herxheimer's fat stain, sections from the lungs, the liver, the spleen, and the kidneys, diffuse multiple microscopic globules of oil were seen throughout the tissues. Animal 3 was killed on the tenth day following injection. Examination of the lungs showed multiple hæmorrhagic areas throughout, very similar to those in animal 1 aside from a darker color of the lesion. These lesions were slightly elevated, firm in consistence, and a dull brown in color. The microscopic examination of these areas showed collapsed alveoli, engorgement of the capillary vessels with an infiltration of red cells, and numerous mononuclear and polymorphonuclear leucocytes. Animal 5 was killed on the twenty-eighth day following injection and postmortem examination of the lungs showed frequent areas throughout of a dull red-brown color, moderately firm in consistence and slightly elevated. Microscopic examination of these areas showed some infiltration with mononuclear and polymorphonuclear leucocytes and a large amount of fibrous tissue.

Animals 2, 4, and 6 were kept under observation for a period of 2 months without showing any unusual symptoms and appearing in normal condition at the end of this period. None of the animals used in these 6 experiments showed any respiratory distress, evidence of pain, or other symptoms which were attributable to the intravenous injection. In each of the above experiments the animals received approximately three times the amount of iodized oil intravenously which would normally be required to make a pyelogram and ureterogram in the dog. A study of the various stages in the above experiments would indicate that a temporary embolic obstruction of the small pulmonary vessels had taken place and that resolution had followed with no serious results to the animals.

4. Has iodized oil any bactericidal or bacteriostatic action?

Agar plates upon which iodized oil was smeared were inoculated with bacillus coli, staphylococcus aureus, and streptococcus hæmolyticus. Upon examining these plates, it was found that the organisms were growing in close proximity to the globules of oil, and no inhibitory action was observed. Quantities of the iodized oil exposed to the air for several months showed no evidence of

[1] This plate was loaned by Dr. W. H. Van Wart. The ureteral stricture was produced experimentally and is a part of unpublished experimental research.

decomposition, and no colonies of bacteria or fungi were observed.

CLINICAL STUDY

Iodized oil was used as a pyelographic medium in 27 patients with various urinary conditions as shown in Table 1.

TABLE 1. URINARY CONDITIONS IN 27 PATIENTS

Normal kidney and ureter	5
Double kidney	1
Horseshoe kidney	1
Renal ptosis	2
Hydronephrosis	3
Ureteral stricture	4
Hypernephroma	2
Renal calculus	3
Ureteral kink	2
Renal infarct	1
Pyelitis	2
Malignant papilloma of renal pelvis	1

Satisfactory shadows of the iodized oil injections were obtained in every case, and in 2 instances when previous pyelograms and ureterograms with a 12.5 per cent solution of sodium iodide solution had failed to cast a shadow sufficient to make a diagnosis.

Iodized oil was found to be especially useful in obese patients, and even a small injection of 0.5 cubic centimeter into the ureter gave a dense shadow. As may be observed in the reproductions of the films, the ureteral shadow is plainly outlined even when superimposed upon the large pelvic bones. Ureteral injections were found to be more complete with iodized oil than sodium iodide solution, probably due to the relative weight of the 2 solutions and the increased viscosity of the iodized oil. That the oil readily escapes from the renal pelvis and ureter was shown in many instances where the oil was removed immediately following the injection. On several occasions repeated roentgen-ray plates of the abdomen 12 hours after the injection showed no trace of the medium.

In this series of 27 cases, 15 patients were allowed to leave the hospital following the examination and 12 were followed in the hospital wards. In no instance were any symptoms detected which could be attributed to irritation from the iodized oil and it was quite evident that these patients were free from many of the distressing symptoms frequently observed following the use of a sodium iodide solution. Following the injection of iodized oil into the ureter, a relief of the symptoms of irritation was often observed, as has been frequently observed to follow the injection of olive oil into the ureter in cases with ureteral calculi. A filling defect of the renal pelvis, resembling a pathological condition, may result from the injection of an insufficient amount of the iodized oil. This was overcome to a certain extent by the use of an emulsion of the iodized oil as described above. The ureteral injections were always made more readily than those of the renal pelvis and iodized oil was found to be particularly useful in ureterography.

Fig. 1. Bilateral pyelogram of live dog, after iodized oil injections, 12 cubic centimeters in right and 5 cubic centimeters in left, showing a hydronephrosis with multiple ureteral strictures and dilated ureter of right side.

CASE 1. J. M., male, married, aged 54; occupation, watchman; entered the New Haven Hospital February 26, 1925. For the past 2 years the patient has had attacks of sharp pain in the left flank, intermittent in character and usually occurring at night. One year before admission the patient fell upon a rock striking his left side. Following this the attacks have become more severe and have been associated with weakness. Six weeks before admission the patient gave up his work and was completely incapacitated on account of the pain. At this time the patient first noticed that his urine was cloudy and contained blood. He also began having nocturia, frequency and burning on urination. The pain became continuous and he was unable to lie on his left side. The personal history is irrelevant.

Fig. 2. Pyelogram and ureterogram in patient with malignant papilloma of left renal pelvis and ureter. Anatomical specimen shown in Figure 3.

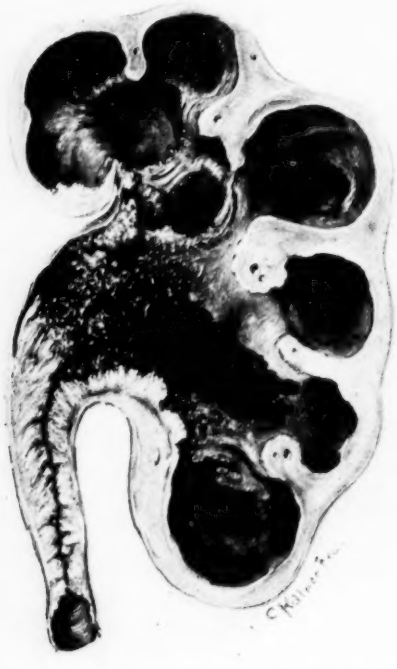

Fig. 3. Drawing of the cut surface of the pathologica specimen in Case 1 showing the renal pelvis and upper ureter filled with tumor. All but one of the calyces were filled with an adherent blood clot.

Physical examination: Aside from a large nontender mass in the left upper abdomen and slight pallor, the examination was essentially negative.

Clinical diagnosis: hydronephrosis, left.

Cystoscopic examination showed a small papillomatous growth about 5 centimeters in diameter protruding from the left ureteral orifice. The growth was villous in character, but the pedicle could not be entirely seen. The left ureter was catheterized with some difficulty and there was no flow of urine from the catheter. Fifteen cubic centimeters of 12.5 per cent sodium iodide were injected through the catheter but no shadow was obtained, the fluid evidently escaping into the bladder.

Repeated cystoscopic examination: A No. 7 French catheter was passed with some difficulty into the left ureter and 10 cubic centimeters of dark bloody fluid escaped. Sixteen cubic centimeters of iodized oil were injected for the pyelogram (Fig. 2).

Diagnosis: papilloma of the left renal pelvis with transplant in the bladder.

Anatomical diagnosis: malignant papilloma of the left renal pelvis (Fig. 3).

Case 2. V. L., female, married, aged 23; occupation, housewife. Previous admissions to the New Haven Hospital: (1) July 13, 1921, spontaneous delivery; (2) March 13, 1922, cystitis and pyelitis; (3) October 5, 1923, mercurial poisoning; and (4) December 12, 1923, gonorrhœal endocervicitis.

February 21, 1925, patient entered hospital. For 8 days previous to admission the patient had attacks of dull aching pain over the right hip. The pain at times was quite sharp in character but not associated with fever or vomiting. The pain frequently radiated down into the inguinal region. Since onset the patient has had nocturia, frequency, and burning on urination, with no history of hæmaturia or passage of calculi. She had lost 12 pounds in weight in the past 4 months. Patient had pyelitis and cystitis in 1922 with the usual symptoms; otherwise the history was irrelevant.

Physical examination: The patient was pale and fairly well nourished. There was definite tenderness in the right upper quadrant with right costovertebral tenderness. No masses were palpable aside from the right kidney which was readily outlined. The physical examination was otherwise essentially negative.

Cystoscopic examination showed the bladder mucosa dull in appearance; the bladder urine showed occasional pus cells and many colon bacilli. Both ureters were catheterized without difficulty and both urine specimens were negative upon examination. Eleven cubic centimeters of iodized oil were injected for a pyelogram and ureterogram of the right side.

Diagnosis from cystoscopic examination: right hydro-ureter with stricture. Chronic cystitis.

Examination of the roentgen-ray film (Fig. 4) showed a dilatation of the right ureter down to a point opposite the transverse process of the fourth lumbar vertebra. At this point there was a marked stricture of the ureter for a distance of 1.5 centimeters below which the ureter was somewhat larger than normal.

The patient returned for two ureteral dilatations. The patient was seen 2 months following the last treatment, but refused further treatment because her symptoms had entirely subsided.

CASE 3. F. H., aged 32; occupation, housewife; was admitted to the New Haven Hospital April 24, 1925. Three weeks before admission the patient developed a constant dull aching pain in the right flank. The pain gradually grew more severe and was aggravated by the patient's menstrual flow and by an attack of influenza. The patient had noticed a mass in the right flank following the onset of the present illness. She had marked burning and frequency of urination but no other urinary symptoms. She at times felt chilly and nauseated, but did not vomit.

Physical examination: There was a moderately large tender mass in the right flank, palpable bimanually, and approximately the size of a grapefruit. The liver could be palpated separate from the mass. The examination was otherwise essentially negative.

Clinical diagnosis: right hydronephrosis.

Cystoscopic examination was made and the right ureteral catheter ascended to a distance of about 4 centimeters where an obstruction was encountered. Both ureteral specimens of urine were negative. The bladder urine showed numerous bacilli and an occasional pus cell. Thirteen cubic centimeters of 12.5 per cent sodium iodide were injected into the right catheter. The resulting roentgen-ray film showed a dilated right renal pelvis but the ureter was not well outlined.

Diagnosis from cystoscopic examination: right hydronephrosis, right hydro-ureter with stricture and chronic cystitis.

Repeated cystoscopic examination was made and bougies Nos. 5 to 9 French were passed with some difficulty into the right ureter, an obstruction being met at approximately 5 centimeters from the ureteral orifice. A No. 6 French catheter was then introduced into the right ureter well beyond the stricture. After the injection of 4 cubic centimeters of iodized oil the patient began to complain of discomfort and the ureterogram was taken at this point.

Fig. 4. Case 2. Ureterogram of patient after injection of iodized oil, showing a stricture of the lower ureter with dilated ureter above the strictured area.

An examination of the film (Fig. 5) shows a stricture about 3 centimeters in length extending over the pelvic brim. The catheter appears within the stricture area as it was left in place. This patient received 3 ureteral dilatations at intervals of 10 days. The patient's symptoms were entirely relieved by these treatments and when she was seen 3 months following the last treatment had had no pain.

CASE 4. P. K., aged 54; occupation, motorman; on admission to the New Haven Hospital complained that he had had pain in the back for the past 10 days, having been compelled to stop work 4 days before admission. The lumbar pain dated back for a period of 10 years with a history of frequency of urination and nocturia for that period.

Physical examination was essentially negative.

Cystoscopic examination: A No. 5 French catheter ascended for a few centimeters up the left ureter where a very firm resistance was encountered. A No. 4 French bougie passed to the left renal pelvis with only slight resistance. A No. 7 French bougie would not pass the place of resistance met by the No. 5 catheter. A No. 6 French catheter was inserted as far as the point of obstruction and 6.5 cubic centimeters of iodized oil were then injected for a ureterogram with the result shown in Figure 6.

The patient received three ureteral dilatations following which he was almost entirely relieved of his symptoms.

CASE 5. A. M., aged 50; occupation, factory worker. Five days before admission to the New

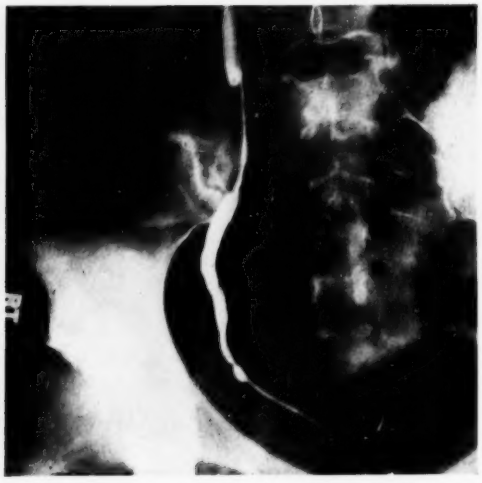

Fig. 5. Case 3. Stricture of the ureter extending over the pelvic brim. The ureteral injection of 4 cubic centimeters of iodized oil was made with the catheter in place.

Haven Hospital the patient was seized with a sharp pain in the left flank and back which radiated to the bladder region. The pain was severe in character and completely incapacitated the patient. Soon after the onset of the pain the patient took a dose of castor oil which he immediately vomited. The patient had a second and very similar attack of pain 12 hours after the first which was followed by vomiting and burning on urination. Otherwise the history was essentially irrelevant.

Physical examination: There was slight tenderness on pressure over the left kidney, otherwise the examination was essentially negative.

Cystoscopic examination was made and showed a small bright red blood clot protruding from the left ureteral orifice. A catheter was passed into the left ureter but met an obstruction at approximately 10 centimeters from the ureteral orifice. Several attempts were made to overcome the obstruction without success. An intravenous injection of phenolphthalein gave no excretion from the left ureter in 30 minutes. The urine specimen showed many red blood cells and a few pus cells but no organisms. Only a few cubic centimeters of 12.5 per cent sodium iodide solution could be injected into the left ureter. The resulting roentgen-ray film showed a faint irregular shadow in the left renal pelvis and ureter.

Repeated cystoscopic examination: A Garceau catheter was passed into the left ureter. About 14 cubic centimeters of dark bloody fluid escaped from the catheter. Following this 15 cubic centimeters of iodized oil were injected for the pyelogram and ureterogram. The resulting film (Fig. 7) shows a dilatation of the upper calyces, and the lower calyces and the upper portion of the ureter are very

Fig. 6. Case 4. Ureterogram showing a very narrow stricture a few centimeters from the bladder. It was impossible to pass the catheter beyond the point of stricture. Six and one-half cubic centimeters of iodized oil were used.

irregular in shape. There is also a well defined right ureteral kink.

Operation: A left nephrectomy was done and the patient made an uneventful recovery from the operation.

Anatomical diagnosis: Infarct of kidney, nephrolithiasis, chronic pyelitis, and ureteral stricture, left.

An examination of the anatomical specimen (Fig. 8) showed the upper portion of the kidney to consist of collapsed cysts containing numerous calculi. The kidney parenchyma was replaced by an overgrowth of fibrous tissue with hyalinized glomeruli. The blood vessels were thickened and sclerotic. There was a stricture of the ureter 4 centimeters from the pelvis.

SUMMARY

A solution of iodized oil containing approximately 40 per cent iodine in chemical combination with a vegetable oil has been found by many investigators to be almost entirely free from toxic properties when used for

Fig. 7. Case 5. Pyelogram and ureterogram after injection of 15 cubic centimeters of iodized oil showing ureteral kink, multiple ureteral strictures, and defects of the renal pelvis due to degeneration of the kidney. Pathological specimen shown in Figure 8.

intratracheal and intrathecal injections. It has been found to persist in the body cavities following injection for many months, being gradually absorbed without causing symptoms of irritation.

The iodized oil was used upon a series of laboratory animals as a pyelographic medium giving excellent results and producing no evidence of toxicity or irritation of the urinary tract.

When injected into the venous circulation in dogs in large amounts, it was found to cause areas of temporary congestion with hæmorrhage and infiltration of the alveoli of the lungs, but animals observed for a period of 2 months showed no untoward symptoms.

The iodized oil was found to possess no appreciable bactericidal or bacteriostatic action.

In the clinic, very satisfactory ureterographic and pyelographic shadows were obtained when an emulsion of iodized oil was used. This was true in 2 cases when previous pyelograms and ureterograms made after the injection of 12.5 per cent sodium iodide failed to cast a shadow sufficient to make a diagnosis.

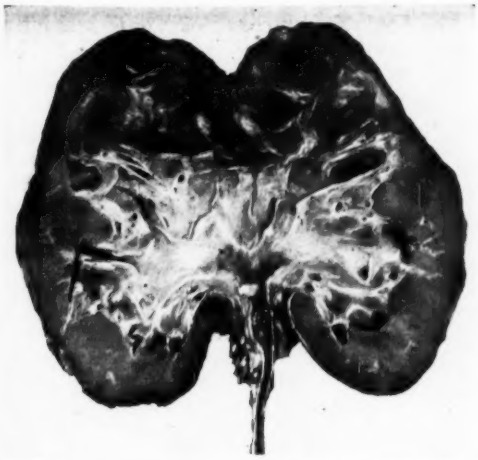

Fig. 8. Photograph of pathological specimen, Case 5, showing degeneration with renal calculi and multiple ureteral strictures following an infarct of the kidney.

Iodized oil was found to be especially useful in obese patients and even a small injection of 1 to 2 cubic centimeters into the ureter gave a very dense shadow. Ureteral injections were found to be more complete with iodized oil than sodium iodide in several instances in which a direct comparison was made.

The oil was found to escape readily from the urinary tract and roentgen-ray examinations 12 hours following the injection gave no evidence of residual oil within the renal pelvis or ureter.

Iodized oil was used upon a small series of patients with good results. Some of the patients examined had had marked destruction of renal tissue, but the iodized oil injections were borne without symptoms of irritation or evidence of any harmful effects upon the diseased kidney.

CONCLUSIONS

1. Iodized oil 40 per cent has no marked bactericidal or bacteriostatic properties.

2. Iodized oil 40 per cent, injected intravenously in dogs in quantities 3 times that used for the average pyelogram and ureterogram may produce areas of congestion and hæmorrhage in the lungs without any permanent anatomical change, the animals showing no symptoms of irritation or toxicity over a period of 2 months.

3. Iodized oil 40 per cent may be used to inject the urinary tract in laboratory animals and patients without resulting symptoms of irritation or toxicity.

4. This preparation appears to offer a pyelographic medium which is superior to those in use at the present time in regard to toxicity and degree of opacity to the roentgen ray.

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STREPTOCOCCUS IMMUNIZATION OF RABBITS IN PREVENTION OF STREPTOCOCCUS ARTHRITIS

Preliminary Report

By LAWRENCE H. MAYERS, M.A., M.D., and META L. SCHROEDER, Ph.D., Chicago

NUMEROUS attempts have been made to offer satisfactory theories concerning the cause of arthritis, but a careful review of the literature tends to show that bone and joint inflammations are very commonly caused by a bacterial infection. It is a well known fact that an inflammation of the joints often follows and, sometimes, precedes an acute general infection, or accompanies chronic foci of infection. Upon removal of these foci the arthritis may disappear at once, or it may become active for a period and then disappear. Attacks of acute arthritis, like all bacterial diseases, are accompanied by a rise of temperature and by a leucocytosis. The secondary symptoms of this disease, such as metabolic disorders and menstrual disturbances, which often complicate its clinical picture, can all be explained upon the basis of bacterial infection. Furthermore, autopsy and biopsy procedures on arthritics have definitely demonstrated the presence of bacteria in the lesions. That these bacteria may be the primary cause of arthritis has been proved by animal experimentation. Laboratory animals injected in a proper manner with certain bacteria will develop arthritis in practically all the different ways in which it is manifested in the human. As in the human, the infection is more likely to attack those joints which are more weight bearing or are more subject to accidental traumatization. This is practically the extent of our knowledge of the subject of etiology. We are not at all sure how many different kinds of bacteria are capable of causing arthritis, under precisely what conditions they cause it, or, whether certain bacteria always cause a certain type.

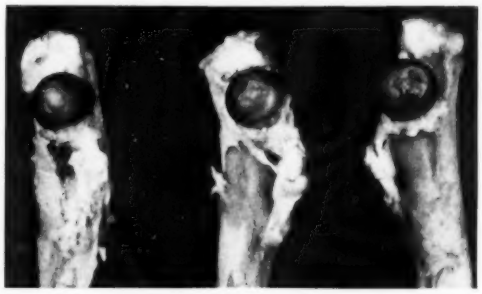
Specialists in the various branches of medical science have classified the different types of arthritis on the basis of evidence with which they happened to be familiar. The bacteriologist, for example, has classified this disease according to the causative organisms; the pathologist, according to the lesions found; and the clinician, according to the clinical findings, which he, of course, interprets from the standpoint of his particular specialty. These classifications, however, have been of

little value to the general practitioner, and, indeed, it does not seem possible on the basis of our present knowledge, to devise a classification which will take adequate account of the multiform, and often seemingly contradictory, evidence that has been accumulated.

Methods of treatment, likewise, have taken many forms. Chemical and physical means are but palliatives; correction of metabolic disturbances merely increases resistance to continued infection; immobilization of joints, with the idea of preventing irritations, by means of casts, interferes with the normal circulation of the bone, while the immobilization by means of surgery, is often the direct cause of a polyarthritis. The removal of accessible foci may sometimes effect a cure, but it is evident that such methods are useless in case of inaccessible foci, foci in vital organs, or more generalized infections. Vaccine or serotherapy, which theoretically ought to be the best means of curing arthritis, assuming the disease to be of infectious origin, has thus far not proved generally successful, although striking results have unquestionably been obtained in isolated instances.[1]

In view of the fact that the bacterial field seems to be the most logical as well as the most promising one for investigations on arthritis at the present time, we have selected this field for special experimentation and are here presenting a preliminary report of the results of our work.

The organisms used in this experiment were two strains of streptococcus viridans, both isolated from the blood of patients having an endocarditis and one strain of streptococcus hæmolyticus isolated from pus of a knee abscess. These organisms when injected into rabbits produce joint changes causing lameness, tenderness and, at times, swelling of the infected parts. At autopsy, these rabbits may show either a purulent or non-purulent synovitis, chondritis, or tenonitis, or an osteitis and bone erosion. The photograph (Fig. 1) shows a normal hip joint of a rabbit, *a*, and two views of a non-purulent arthritic joint, *b* and *c*, which show an erosion and a slight extension of the infection into the bone.



a. *b.* *c.*

Fig. 1. Photographs of *a*, normal hip joint, and two views *b* and *c* of a non-purulent arthritis joint, which show an erosion and slight extension of the infection into the bone.

Evidence of bone and joint changes in rabbits injected with these organisms is also given by the X-rays taken of living animals, which showed lameness and tenderness of joints.

The X-rays, Figures 2 and 4, of the lower forearm including the carpal and metacarpal bones, in anteroposterior and laterial views, show very marked tumefaction of the soft structure about the carpus with malposition of the metacarpal bones. There is a definite area of haziness in and about the joint space characteristic of the density of purulent fluids. There is definite evidence of partial destruction and erosion of the ends of the radius and ulna and also of the carpal bones. The shadows follow the tendon sheaths well down along the metacarpal and phalangeal bones. Figures 3 and 5 show the same views of a normal lower forearm in which the bones appear in their usual position and density. The epiphyses are those of young, well developed animals.

The anteroposterior and lateral views of the ankle joint in Figures 6 and 8 show marked tumefaction in and about the joint and the haziness is that most commonly seen of purulent fluids. In the anteroposterior view, there is evidence of destruction of the tarsal bones with irregularity of the joint surface and an extension along the tendon sheath. Figures 7 and 9 show the corresponding views of a normal joint.

[1] The work of Dr. Reginald Burbank may here be noted. Dr. Burbank's method of treating arthritis with autogenous vaccines is the most extensive vaccine treatment that has yet been instituted and seems to be proving successful. This vaccine is now being tried clinically by one of us.

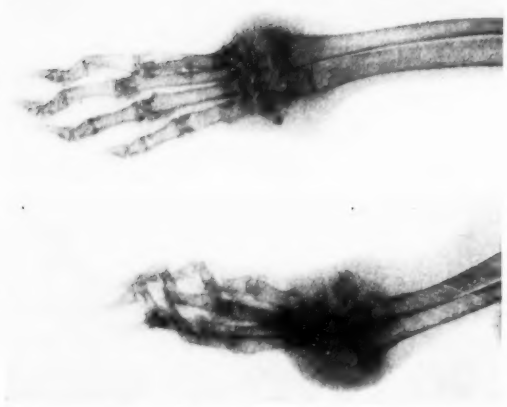


Fig. 2. Anteroposterior roentgenogram of lower forearm with carpal and metacarpal bones, showing marked tumefaction of the soft structure about carpus and malposition of the metacarpal bones.

Fig. 3. Anteroposterior roentgenogram of normal lower forearm. The bones appear in their usual position and density.

Fig. 4. Lateral roentgenogram of same foot as shown in Figure 2.

Fig. 5. Lateral roentgenogram of same foot as shown in Figure 3.

The knee joint in Figure 10 shows marked involvement in and about the joint with evidence of a destructive process involving the articular surfaces of the joint, but apparently the destruction is most marked in the cartilaginous structure. A normal knee joint in similar position is shown in Figure 11.

The object of our experiment was to test the protective value of a specific streptococcus extract prepared according to the rapid freezing and thawing method devised by Dr. C. O. Melick.[1] The method of procedure was as follows: the 48-hour broth cultures (total 300 cubic centimeters) of the streptococcus strains mentioned above, were centrifugalized and

[1]Melick, C. O. J. Med. Research, 1922, xliii, 37.

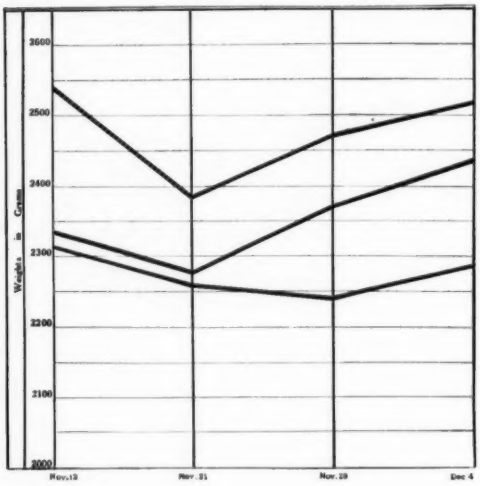


Chart 1. Weights of control rabbits.

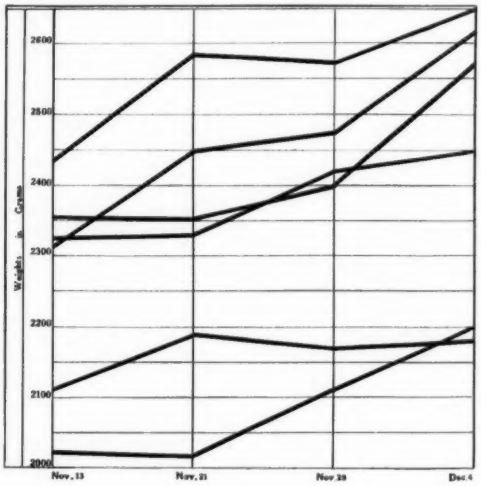


Chart 2. Weights of immunized rabbits.

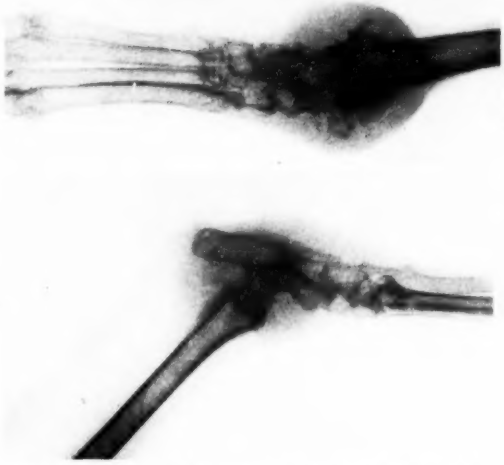


Fig. 6. Anteroposterior roentgenogram showing marked tumefaction in and about joint and haziness most commonly seen in the presence of purulent fluids.

Fig. 7. Lateral roentgenogram of same foot as shown in Figure 6.

Fig. 8. Anteroposterior roentgenogram showing marked tumefaction in and about joint and haziness most commonly seen in the presence of purulent fluid.

Fig. 9. Lateral roentgenogram of same foot as shown in Figure 8.

the supernatant broth removed. The sediment was suspended in sterile physiological salt solution, again centrifugalized and the supernatant fluid drawn off. This process of "washing" was repeated three times to remove as much of the culture medium as possible. Finally, the sediment of organisms was suspended in exactly 20 cubic centimeters of sterile physiological salt solution. This suspension of organisms was subjected to 23 rapidly repeated processes of freezing and thawing, and was then passed through a Mandler filter. The filtrate was collected in sterile vaccine bottles and when tested culturally for viable organisms was found to be absolutely sterile. Its toxicity was tested by injection into white mice. These animals showed no ill effects from the largest dose injected, namely, 1 cubic centimeter.

For the immunization experiment, six half-grown rabbits were injected intravenously at three-day intervals with 1 cubic centimeter, 2 cubic centimeters, and 4 cubic centimeters, of the extract. No ill effects from the injection were noted. Twelve days after the last injection of extract these six rabbits and three normal rabbits were each injected intravenously with living organisms of the same strains used in the preparation of the vaccine, in amounts equivalent to 3/10 of the 24-hour growth on one blood agar slant. Three days after this injection the first symptoms of

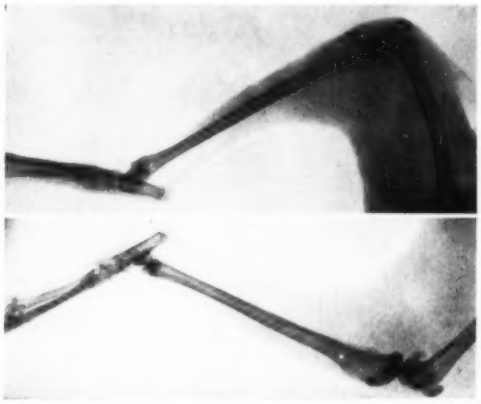


Fig. 10 (above). Knee joint showing marked involvement in and about the joint with evidence of a destructive process involving the articular surfaces of the joint. Destruction is apparently most marked in cartilaginous structure.

Fig. 11. Roentgenogram of normal knee joint in similar position to that in Figure 10.

lameness were noted in one of the control rabbits. All of the control rabbits showed joint involvement manifested by swelling and lameness; two of them showed involvement of all joints at various times during the entire period of the experiment, and one, apparently only of the hind legs. The treated rabbits showed no symptoms whatsoever, except in the case of one animal which showed lameness for several days, but upon autopsy no lesions were apparent.

The actual difference in the condition of the treated and control rabbits after they received an injection of living organisms, is shown in a very striking manner by their weights which are given in Charts 1 and 2. The control rabbits all show an immediate loss in weight after the injection, and at the end of 3 weeks only one had regained his original weight. The treated rabbits, on the other hand, gained or at least maintained their weight immediately after injection, and at the end of 3 weeks all except one showed a very decided increase. This, together with the absence of symptoms in all but one of the group, proves that the treated rabbits had acquired a resistance which protected them against a dose of living streptococci capable of producing an active arthritis in normal rabbits.

Although the number of animals in our experiment is small, nevertheless, we feel justified in concluding, from the clear-cut results obtained, that protective inoculation against intravenous streptococcus infection in rabbits is possible by means of our specially prepared bacterial extract and that further investigation of its usefulness is fully warranted.

We wish to thank Dr. Edward H. Hatton of Northwestern University Dental School for making animal experimentation possible for us, and Dr. Carroll Eugene Cook for taking the X-rays.

THE PHYSIOLOGICAL SIGNIFICANCE OF THE GALL BLADDER[1]

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As regards the function of the gall bladder there is a difference of opinion among physicians. Up to a short time ago, most of the physiologists saw in the gall bladder a simple reservoir in which the bile or a part of the bile could be accumulated for a time, and probably made better fitted for the work which it is described as doing in digestion. The possibility has also been considered that the gall bladder may serve as a regulator, a steam-kettle, through which the expansion of the bile ducts is regulated; and at the same time as an abductor of bile into the intestinal canal. Others take it for granted that the gall bladder contracts at certain times, and as a result a larger quantity of bile flows to the duodenum when the organs of digestion require more stimulation.

Tigerstedt mentions in his compendium the fact that during periods of abstinence or fasting, the bile flows not to the gut but into the gall bladder. Water is absorbed and the slime separated with the result that the bile becomes more concentrated. While bile is formed continuously in the liver it runs into the gut during digestion only. This physiologist further states that through the movement of the diaphragm during respiration a pressure is exerted which is of significance in the evacuation of the gall bladder. This is certainly not logical, as one asks himself immediately if during fasting the inspiration pressure of the diaphragm has been interrupted.

Van Hengel has asked in his dissertation on cholecystectomy, published in 1912: "What significance has the gall bladder?" He gives an exhaustive review of the different opinions as to the manner in which the bile is separated and the part played by the gall bladder. After critical consideration of the different conceptions and after experiments on animals, he comes to the following conclusion: "The bile flows during periods of non-digestion as well as during periods of digestion, a part to the gall bladder and the rest to the duodenum, without hindrance from the sphincter of Oddi. During fasting the bile flows to the gall bladder until this is filled, the rest goes to the duodenum. After nourishment has been taken, there should arise with peristalsis of the duodenum contraction of the gall bladder and of the bile ducts, in consequence of which there is an evacuation of the gall bladder and a temporary increased separation to the duodenum."

Zwaardemaker says in his physiology (3d ed. 1920): "The gall bladder forms obviously a reservoir wherein the bile may be stored in times of need; the wall undergoes rhythmical contractions, 1 to 3 per minute. These contractions should be stimulated by the vagus and inhibited by the sympathetic; the expulsion should take place freely, with great force; this would be indicated by the presence of the muscles.

It is in every way comprehensible that the question as to the significance of the gall bladder has come prominently forward, in accord with the extension and development of the surgery of the bile ducts. One of the principal arguments for or against cholecystectomy is closely connected with the significance to be ascribed to the gall bladder.

It is known that certain animals such as the horse, rat, and peccary, have no gall bladders, and that in human beings, in a few cases the pathological anatomist has observed an agenesis.[2] In all other animals the gall bladder is present, and is in no sense a rudimentary organ as is the appendix. From this it is to be inferred that the function of the gall bladder is not unimportant. In its early developmental stages, it is extremely large. The way in which the gall bladder is connected with the liver differs in the different animals very much. In some cases there is complete separation, in others they are closely connected, sometimes one duct, or two or more bile ducts

[2] Broman, I. Ueber die Phylogenese der Gallenblase. Upsala Läkaref. Förh., 1921, xxvi.

[1] Read before the Netherlands Society of Surgery in Rotterdam.

flowing directly to the gall bladder. Whether those direct connections are only primary or secondary is not yet proved.[1]

It would certainly be of interest to know, whether in animals having no gall bladder, particular anatomical functions could be pointed out in which the non-existence of the gall bladder is compensated for in one way or another. In the case of the horse with a liver weighing 4 to 5 pounds we find a choledochus as wide as a man's finger, while the gall bladder is missing. The significance of the gall bladder as a reservoir is certainly of minor importance, for there is a daily production of about 1 liter (32 liquid ounces) of bile. Compared with this amount of bile, the capacity of the gall bladder is small.

Experiments on animals have done but little to give us a clear view on the function of the gall bladder. This is not astonishing because in performing experiments on animals we create a pathological condition and therefore we may not rely on the results so far as the uninjured gall bladder or bile ducts are concerned.

One thing of consequence which is proved by the foregoing and which is in accordance with Dr. Van Hengel's experiences, is that the bile ducts always enlarge when the gall bladder is taken away. This enlargement is very pronounced when the gall bladder is removed with the ductus cysticus, and is less pronounced when a part of the ductus cysticus is left. It seems that not only is the papilla vateri influenced by the loss of the gall bladder but also that this end of the ductus choledochus becomes wider.

Yet every surgeon knows that in the clinic this phenomenon reappears. Almost always we find distended bile ducts when the gall bladder has been put out of function, either when it has been removed by an operation, or through shrinkage or through chronic obstruction of the cystic duct.

About the existence or non-existence of the so-called sphincter of Oddi, opinions are divided. Probably there exists a sphincter working, but disregarding the fact, whether this sphincter can be indicated anatomically or not, the clinic teaches us that the normal bile ducts are protected in any case against the entrance of the contents of the duodenum by a barrier, and not alone by the bile stream itself. The peculiar natural entrance of the ductus choledochus into the duodenum is difficult to replace by an artificial one without disturbance.

As one proof of this, the case of a patient is given who is still in the Rotterdam Hospital. In this patient it had become necessary to plant the proximal part of the ductus hepaticus in the duodenum about a year ago because the end of the ductus choledochus was obliterated during cholecystectomy. The flow of bile returned to normal, but every time an angiocholitis formed which must be ascribed to ascending infections along the intestinal canal.

Somewhat similar ascending infection is to be seen after the artificial implanting of the ureter into the bladder. The widening of the bile ducts always seen after the gall bladder is disconnected from the ducts, must be ascribed to the pressure which the bile exerts on the walls. The pressure inside the bile ducts is dependent upon different factors.

Various physiological influences are present. The quantitative differences in the separation of the liver bile, the movements of the diaphragm, the abdominal pressure, the different attitudes of the human body, pregnancy, the grade of swelling of the intestinal loops, etc. are of influence on the situation of the bile ducts and the pressure inside the ducts. And the pathological factors are also of no less importance. Therefore we must take it for granted that the bile ducts possess a means by which they can act under altered internal or external conditions with the effect of differences in pressure. Apparently this is what happens when the gall bladder is removed—it possesses this means even though it must be regarded as a protecting reservoir for the bile ducts. If this protecting organ is removed, then the bile ducts are not able to withstand a higher pressure; they lose their elasticity, and become stretched.

The clinic teaches us that the gall bladder can be extensively stretched, usually without injury, probably because of the presence of muscles near other elastic elements. Often during laparotomy the surgeon sees the formerly

[1] MacMaster. Do species lacking a gall bladder possess its functional equivalent? J. Exper. Med., 1922, xxxv.

greatly distended gall bladder shrunk back to normal dimensions, not as a weak sack but with smooth walls showing no evidence that a swelling has been present. The muscles of the walls of the gall bladder have been for many people the proof of active participation of the gall bladder in the movement of bile into the duodenum, adapted to the lack of bile for the digestion within the intestinal canal. Others, however, who think these muscles are unfitted for this work, believe that evacuation of the gall bladder takes place through peristalsis of organs in the neighborhood, or through pressure of the diaphragm. It would seem that physiologists wanted to see an evacuation of the gall bladder after certain periods by some means or other in any case!

The experience of the surgeon is contrary to this. During a laparotomy nothing is found that would prove that the gall bladder takes an active part in the discharge of bile to the gut canal. Under normal conditions the gall bladder is always full; we never find it absolutely empty; the surgeon does not see the active working, the contraction of the peristalsis even during long and repeated observation. We also get no impression that the filling of the gall bladder is very dependent on the digestion. During fasting the gall bladder is certainly not enlarged as a rule, as one might think it would be on considering reports about the function of the gall bladder.

Indeed, laparotomy is always performed just after a fasting period.

Under most pathological conditions, the gall bladder is considerably enlarged. Therefore, I recall that I as well as others have observed an enlargement of the gall bladder in acute pancreatitis. This enlargement is a natural result of higher pressure in the bile ducts. The experiments on dogs by Auster and Crohn[1] in 1922 agree with this fact in all respects. After laparotomy and duodenotomy, methylene blue was injected into the gall bladder. After this the duodenal mucous membrane near the papilla vateri was stimulated with magnesii sulphas. More bile was then evacuated, though no bladder bile. The gall bladder kept the bile independent of the digestive conditions. Attempts made to cause the gall bladder to contract through nerve excitement failed. Also strong electric incitement of the gall bladder was without effect. A lot of experiments with the aid of sterilized suspensions of fine substances such as bone ash and carmine, have shown that the gall bladder holds its contents for a long time, sometimes for days. Also, in the presence of gall-bladder fistula, the impression is not received that the bile stream is controlled by contractions of the gall bladder. With certain regularity the bile drips through the fistula, occasionally in quicker tempo through the influence of intestinal pressure.

When the surgeon empties the gall bladder with the finger, it refills gradually and irregularly, according to the amount of liver bile excreted. Here, too, the argument seems unwarranted that a sucking process may be present in the gall bladder. At the same time, the gall bladder is well able to rid itself of a part of its contents in a short period. It is, however, a question whether in the first place bile escapes along the ductus cysticus. The anatomical relations of the gall bladder, ductus cysticus, hepaticus, and choledochus are not such as to give the impression that nearly all of the bile—as sometimes is thought—reaches the ductus choledochus after having passed into the gall bladder. The spiral course of the ductus cysticus otherwise difficult to explain does explain the stretching to which the gall bladder and ductus cysticus are exposed. The evacuation of the gall bladder is not easy via the ductus cysticus. This fact can be demonstrated by attempting to empty the gall bladder with the fingers. Considerable resistance must be overcome.

It is known that bile is found in more concentrated form in the gall bladder than in the bile ducts, and this is because much fluid can be resorbed from the gall bladder. The extensive lymph apparatus furnishes this resorbent power. Besides water, which seems to be worked up quite easily, other substances can also be taken up; in fact all the elements of bile can be carried off with the lymph. Indeed, by an enclosure of the ductus cysticus is often found a watery fluid containing slime only, of which the former content was bile. Now and then cholesterin is taken up in such very large quantities through the mucous

[1] Proc. Soc. Exper. Biol. & Med., 1922, iii, 19.

membrane of the gall bladder that it fills up the villi of that membrane (strawberry gall bladder).[1] The gall bladder can lose most of its contents by resorption, and in this sense it becomes *significant as a protective factor.*

The experiments of Rous and McMaster[2] in 1921 showed that the gall bladder has considerable power of resorption. They performed experiments with dogs and pointed out that the amount of bile in a gall bladder completely empty at the beginning of an experiment which was filled gradually with liver bile, was reduced in 24 hours to one-tenth the original amount, this reduction being less when the gall bladder was filled in advance with bile containing a certain amount of pigment.

In the clinic, the significance of the gall bladder as a resorbing organ under pathological conditions, becomes manifest. Others have pointed this out, and I have observed in about 6 cases that the appearance of so-called "white bile" in the bile ducts marks a pronounced change in the gall bladder, so much so that it may be doubted whether there may not be ascribed to it some resorbent power. The so-called white bile may be found sometimes when the bile ducts have been obstructed in cases with high-grade icterus; and it consists of water with some slime (as this may be found in the gall bladder alone). This white bile is not often found in the bile ducts; generally when the ducts have become obstructed they clearly contain bile, sometimes a very strong, thick bile.

It is to be in some way understood that the contents may become watery only when the gall bladder absorbs little or not at all. Only in that case is the expansion within the bile ducts so great that the secretion of bile from the liver is interrupted; if the gall bladder resorbs efficiently, then the liver continues—it may be poorly—giving off bile to the bile ducts. By means of the white bile in the bile ducts, I have always been able to find an enlargement of the ducts.

The gall bladder is therefore not a reservoir from which the contents stream in and out under the influence of muscle contractions; but more an organ that controls the expansion of the bile ducts, first by a power to become greatly enlarged and retain much for a certain time, and second by a strong resorbent power, through which in a short time much fluid can be carried off.

The internal and external parts of the mucous membrane of the gall bladder are in absolute harmony with this resorbent power. During fasting the gall bladder is certainly not without necessity enlarged, much more does the rich bile stream during digestion give cause for filling of the gall bladder. The gall bladder does not take an active part in the bile separation. Only a part of the liver bile runs into the gall bladder and probably only a small amount of its contents return via the ductus cysticus.

In the gall bladder rules a relative rest. This rest and the concentration which is brought about within the gall bladder through resorption are in accord with the fact that stones are found and formed within the gall bladder so often. In this connection the question arises whether changes in the colloid formation or in inflammation, or both, are the prime cause for the forming of these stones. Also the well-known fact that bacteria may remain for a long time in the gall bladder is in accordance with these conceptions.

CONCLUSIONS

The fact that removal of the gall bladder is not fatal may not be accepted as proof that the function of the gall bladder is not important. Of more significance is the manner in which the organism adapts itself to the loss of the gall bladder.

[1] Boyd, William. Studies in gall-bladder pathology. Brit. J. Surg., 1923, No. 39.

[2] Rous and McMaster. J. Exper. Med., 1921, xxiv, No. 1.

CLINICAL SURGERY

FROM THE UNIVERSITY CLINIC FOR WOMEN'S DISEASES, BERLIN

THE TECHNIQUE OF ABDOMINAL HYSTERECTOMY FOR CARCINOMA OF THE UTERUS[1]

By Professor Dr. K. FRANZ, Berlin, Germany
Director of the University Clinic for Women's Diseases at the Charité, Berlin

FOR twenty-one years, I have used the abdominal route as proposed by Wertheim in operating upon medullary carcinoma of the uterus. The technique to be described here, was evolved in the first five years and has not been changed essentially in the last sixteen years.

The abdomen is opened through a transverse aponeurotic incision (Pfannenstiel). Other incisions have no advantages over this one and if used results a tendency to slow healing and the danger of postoperative hernia. This latter is hardly to be expected when the transverse incision is used.

The incision in the aponeurosis is made approximately on a level with the anterior superior spines, and is 12 to 14 centimeters long. The aponeurosis is well freed upward and downward. If a self-retaining retractor is inserted and well stretched, this incision gives sufficient exposure. The uterus is grasped with forceps and pulled upward and over to one side as much as possible. If the surgeon stands on the right of the patient, the uterus will be pulled over to that side. Two forceps are applied now on the left suspensory ligament of the ovary so as to include the ovarian vessels, and two forceps are placed on the round ligament (Fig. 1). The ligaments are cut between the forceps only so far as they grasp the ligaments. Care must be taken not to take too deep a bite in the suspensory ligament as the ureter may be injured. After the ligaments are cut, the forceps are pulled apart so that the intraligamentary tissue is exposed (Fig. 2).

The same thing is done on the right side. The ligated adnexa and the stumps of the round ligament can be tied together on the anterior surface of the uterus in order to get them out of the way. Now the left parametrium is exposed, if the surgeon is on the right side, with the help of blunt dissecting scissors and tissue forceps. It is the uterine vessels that we must look for and not the ureter. A clear anatomical dissection must expose them. If this procedure is followed, the ureter will also be visible without further search. It lies on the posterior layer of the broad ligament which is now pushed toward the midline and is crossed by the uterine vessels. It can be recognized, if there is any doubt as to its identity, by the fine vascularization of its surface. If there is still doubt, gentle squeezing with a forceps will elicit peristaltic movements.

With two clamps, the uterine vessels are grasped at their origin from the hypogastric vessels. The clamps are placed far enough from each other to permit a section between them. In Figure 3 the second clamp has been removed so that the structures will show more clearly. If the uterine artery and vein lie together, usually the vein lies under the artery, then they are grasped with one bite. If they lie apart, then they must be clamped separately. The proximal clamp on the vessels is immediately replaced by a ligature of catgut. Traction is made on the distal clamp and with it on the part of the vessels that tend toward the uterus. Thereby an additional portion of the ureter is exposed. However, it should not be touched at all.

The surgeon now changes sides. If he stood on the right before, he will now tie from the left side the right uterine vessels and expose the right ureter as described above.

After the uterine vessels have been tied on both sides and both ureters are exposed, the uterus is brought back to the midline and pulled upward. The peritoneum of the bladder is picked up with a tissue forceps and transversely incised at the point where it bends over from bladder to uterus (Fig. 4). The bladder is dissected away from the cervix in the midline only to an extent sufficient to expose the border between the bladder and the wall of the cervix. The surgeon still stands on the left side of patient. The uterus is pulled over

[1] The description is taken from the author's book on *Gynecologic Operations* which was published in 1925 by Julius Springer of Berlin. The illustrations are diagrammatic drawings of the colored photographs shown in this book. Also the clinical results of this operation, both primary and late, are discussed there in detail. This article has been translated from the German by Geza de Takats, M.D.

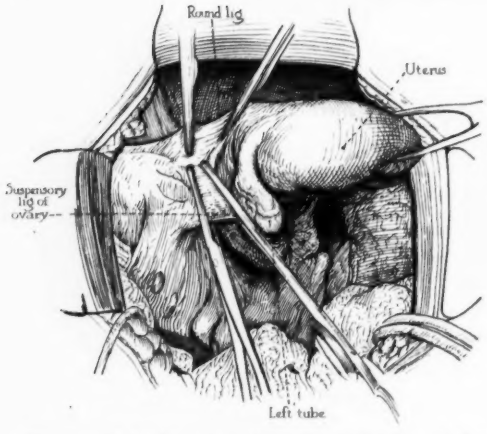

Fig. 1. Abdominal operation for carcinoma of the uterus. The uterus is grasped with a forceps and pulled well over to the right in order to put the left ligaments on a stretch. Both the suspensory ligament of the ovary with the ovarian vessels and the round ligament are to be sectioned between two clamps.

to the left in order to free the bladder laterally from the uterus and to dissect the ureter down to its orifice into the bladder. This part of the operation is the most interesting from an anatomical point of view and technically the most dangerous. There is the possibility of injuring the ureter or bladder especially if an inflammatory or carcinomatous infiltration around the ureter is present. The tissues around the ureter can

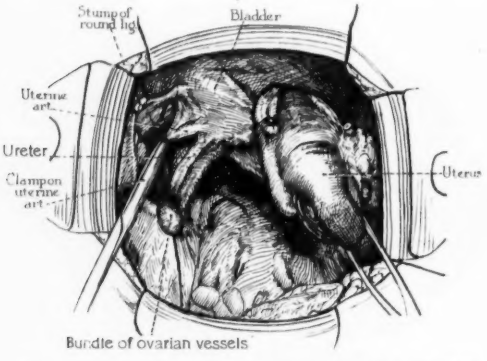

Fig. 3. The uterus is pulled over to the right. The left broad ligament is exposed with the uterine artery. A clamp is applied at its origin. The uterine artery is seen on its course toward the uterus, with an anterior branch to the bladder. On the medial surface of the broad ligament the ureter is seen. The ligature is left long on the ovarian vessels.

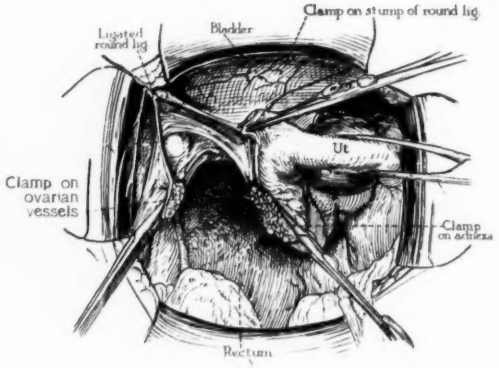

Fig. 2. The uterus is still pulled over to the right. The ligaments have been cut between clamps and pulled apart so as to expose the intraligamentous tissue. The lateral clamp on the round ligament has been replaced by ligature.

be seen in Figure 5. One must know the exact course of the ureter. Down to the point where it crosses the uterine vessels, the course is straight. When traction is exerted on the uterus to the side and upward the ureter takes up a similar course and forms an arch upward and mesially, lying immediately next to the uterus. The tissue forceps picks up the bladder wall, and the parametric tissue above the ureter is sectioned. One or two veins are usually cut at this point. They are ligated immediately. Generally the ureter becomes visible at this point. The incision is now continued laterally and the ureter is dissected away from the wall of the cervix and the medial layer of the broad ligament so that it is

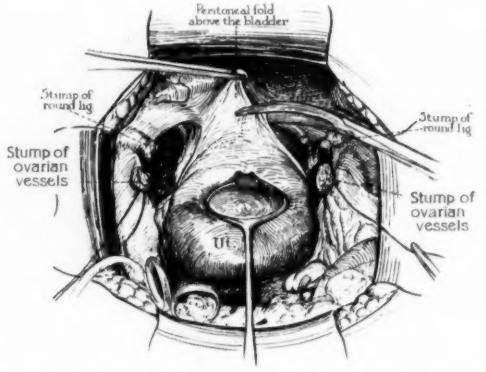

Fig. 4. The uterus is brought back to the midline and drawn upward. The peritoneum above the bladder is picked up with a tissue forceps and is transversely incised with a pair of scissors in the vesico-uterine fold.

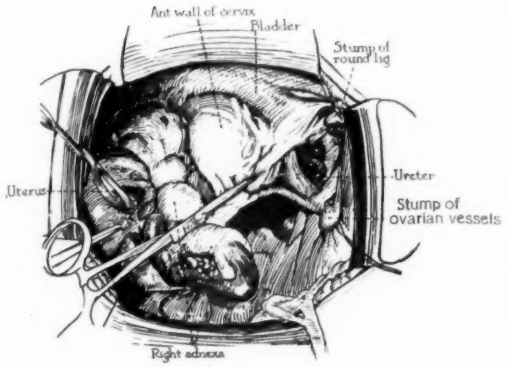

Fig. 5. The uterus is pulled over to the left. The ligatures on the ligaments have been tied together on its anterior surface; the suture on the right ovarian vessels has been left long. Between the layers of the broad ligament the ureter is visible as it is dissected away from the medial surface. The bladder is visible in the front, separated from the anterior wall of the cervix. To the right a clamp is exerting traction on the parametric tissue that extends from the bladder to the lateral wall of the cervix, disappearing under the ureter.

freed in all directions for a length of 5 to 6 centimeters, if possible for a greater distance (Fig. 6). The ureter is followed farther down to the bladder, into which it opens in a tangential direction. This dissection is done with tissue forceps and scissors. The bladder must also be freed below the ureter from parametric tissue. Now the vesicovaginal veins become visible, and

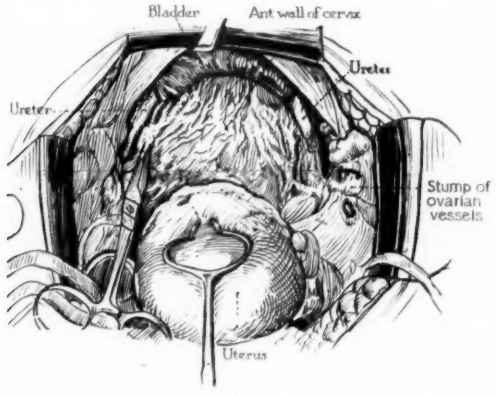

Fig. 7. The uterus is in the midline and pulled upward. The bladder is well freed from the anterior cervical and vaginal wall, as recognized by the distance between the bladder and the free edge of the peritoneal fold on the anterior surface of the uterus. Both ureters are visible clear down to the vesical orifice. On the left side a clamp is applied on a small vessel.

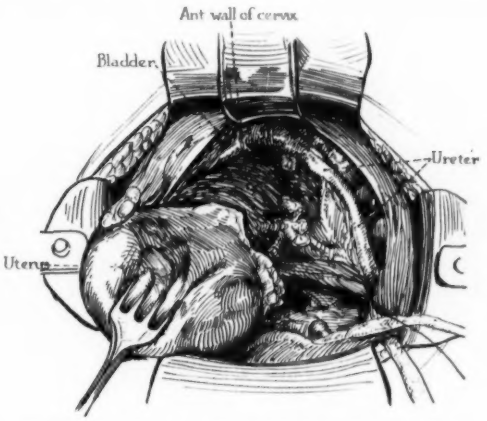

Fig. 6. The uterus is pulled to the left and upward. The bladder is dissected away from the cervix and vaginal wall. The ureter is pulled down to its opening into the bladder. The parametric tissue on which the ureter lies is still left in place.

they should be carefully protected from injury. The surgeon changes places again and dissects in the same way on the other side. When he is ready, the following topography is seen (Fig. 7). Both ureters are free. The bladder is dissected away from the cervix, from the anterior vaginal wall and laterally from the parametric tissue so

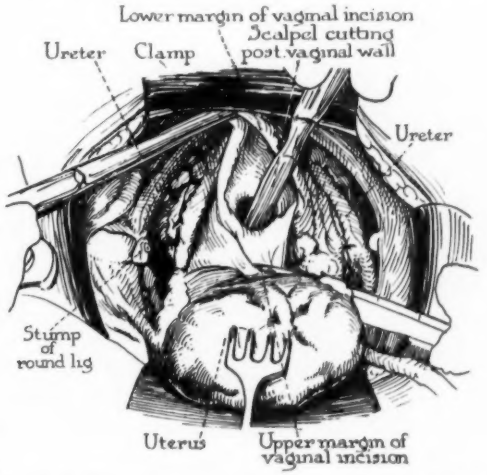

Fig. 8. Transverse incision of the anterior vaginal wall. A Collin forceps holds up the upper lip of the vaginal incision. Another clamp grasps the lower margin of the vaginal wound. The scalpel separates the posterior wall of the vagina transversely.

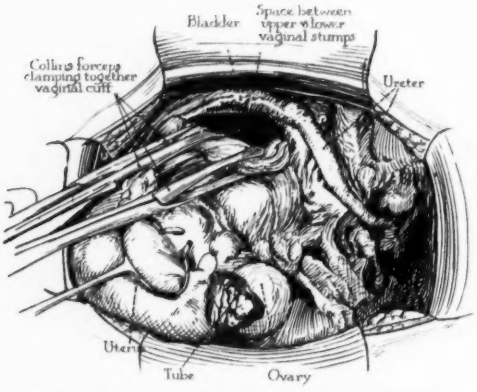

Fig. 9. Anterior and posterior vaginal wall are grasped and held together with three Collin forceps. The right ureter is free down to its vesical end and retracted with a ureteral hook. The pelvic connective tissue of the right side is amply exposed.

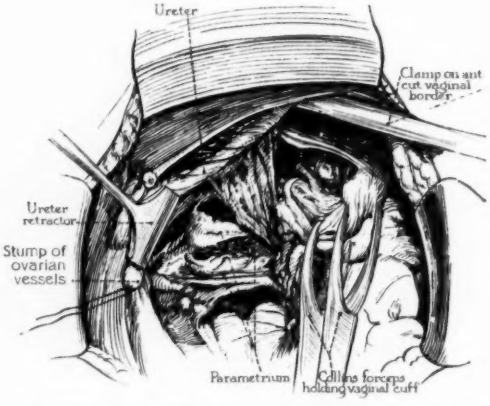

Fig. 10. Anterior and posterior vaginal walls are held together with two Collin clamps and pulled upward. The left ureter is retracted laterally with a special hook. The left parametrium and paracolpium is exposed as far as the lateral wall of the pelvis and is split into three well separated strands of fibers. Toward the symphysis a clamp is applied on the anterior vaginal wall below which the lumen of the vagina is visible.

far as the individual case requires it. Now the gauze pack in the vagina is removed from below, the vagina is opened with a transverse incision from above, and the anterior margin of the vaginal wound is grasped with a Collin forceps. Through the opening in the vagina the posterior wall is also incised transversely with a long bicutting scalpel (Fig. 8). The posterior margin of the vaginal wound, proximal to the uterus is also grasped with a forceps and pulled forward. A gauze pack is now inserted through the anterior and posterior openings in the vagina and carried farther down to pack away the rectum from the upper part of the posterior vaginal wall. The vagina is amputated with a circular incision, and the edges of the vaginal wound are grasped together with two or three Collin forceps, so that the vaginal cuff is closed (Fig. 9).

If traction is made on the proximal vaginal stump and the ureter is held aside with a special retractor (Fig. 10), then the whole parametrium and paracolpium is exposed and it depends entirely on the surgeon how much tissue he wishes to remove both laterally and downward. Not many vessels must be cut at this point. There is a vein on the lateral wall of the vagina, another one farther to the side that comes from the bladder, one or two branches that go downward to the dependent part of the wound and a hæmorrhoidal artery going to the rectum. There is generally a very small vessel in the fold of the Douglas pouch. The vessels are best exposed with blunt dissection with the scissors, and three to four forceps are usually enough on each side. If the left side is dissected out, the position is again changed and the right side cleaned out. Now the uterus is attached only to the right peritoneal fold in the Douglas pouch and as the rectum is pulled up with the traction on the uterus, care must be taken not to open the rectum when the peritoneum is separated at the bottom of the pouch. Only at this stage should the uterus be removed.

All this happens with the surgeon looking constantly into the pelvis from above; he does not have to turn his head to see from the back what he is cutting.

The uterus being removed, the lymph glands must be excised. The surgeon remains on the left side, as he started out originally on the right. If the stump of the round ligament is brought forward with a forceps and the ovarian vessels with their ligatures left long, are drawn up, then the region of the large vessels is exposed. The tissue over the external iliac artery is picked up with a tissue forceps, and the large vessels dissected free as far as their origin from the common iliac artery. The angle formed by the external and internal iliac arteries especially should be completely cleaned out. This will expose the obturator nerve and the obliterated umbilical artery. The whole dissection can be done without any bleeding. The same thing is now performed on the left side. The connective tissue

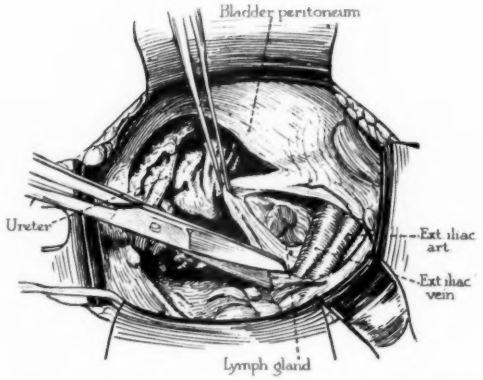

Fig. 11. Removal of connective tissue from the triangle of iliac vessels together with the lymph glands. Dissection of the great vessels.

around the large vessels and in the triangle formed by the two iliac arteries should be removed in all instances, irrespective of whether enlarged glands are present or not.

We have then the following steps in the operation: The surgeon stands on the right side of the patient and

1. Ligates the ovarian vessels and those of round ligament first on right then on left side.
2. Ligates the uterine vessels and exposes the ureter on the left side.

The surgeon goes over to the left side and

3. Ligates the uterine vessels and exposes the ureter on the right.
4. He makes a transverse incision of the peritoneum over the bladder and separates the bladder from the wall of the cervix.
5. He dissects out completely the right ureter.

The surgeon changes places and does a

6. Complete dissection of the left ureter.
7. He incises the anterior and posterior vaginal wall. The rectum is packed off and the vaginal cuff is closed with forceps over the portio.
8. He removes the left parametrium and paracolpium.

The surgeon changes his place and

9. Removes the right parametrium.
10. Extirpates the lymph glands and connective tissue from the great vessels and the vascular angle on the right side.

The surgeon changes his place and

11. Extirpates the lymph glands and connective tissue above the great vessels and the iliac angle on the left side.

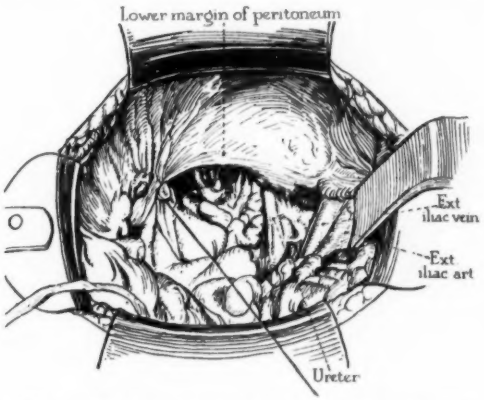

Fig. 12. The wound surface is covered with peritoneum. Beginning from the left stump of ovarian vessels the two peritoneal margins are united with a continuous catgut suture. The suture is completed to a small extent, on the right, the wound is still open. The ureter and large vessels are visible.

In case the surgeon begins the operation from the left side of the patient, the sequence of manipulations will be correspondingly reversed.

The reconstruction of the wound is simple. A strip of gauze is passed from above through the vagina, the upper part of which is loosely packed. The gauze is pushed down flush with the opening in the vagina. It should not touch the wound surface of the pelvic cavity. The pelvic wound is covered with peritoneum by a continuous catgut suture of the anterior and posterior peritoneal margin (Fig. 12 and 13).

This method has been standardly used by us

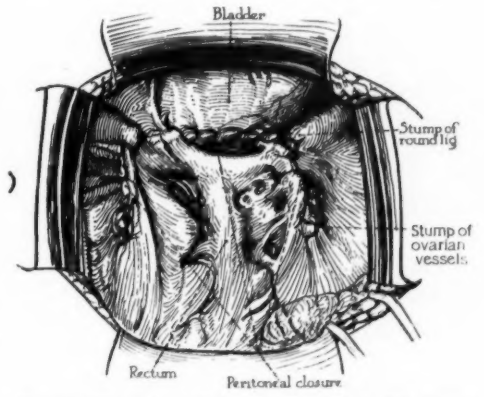

Fig. 13. The peritoneal suture is completed. The wound is entirely covered.

in the last 16 years. Essential changes have not been made since that time. It is as simple as this anatomically and technically complicated operation can be made. The time required is from 30 to 50 minutes, and there is very slight loss of blood. This plan is the result of several experiments that lasted 5 years. I stressed at that time the point of removing all tissue around the uterus and vagina possibly with the glands too in one mass and then opening the vagina as a last phase with the idea of keeping the infected vagina with the broken down carcinoma closed to the end of the operation and so diminishing the danger of infection from this source.

However, this procedure has its special dangers that were not in keeping with the expected advantages. If one proceeds to dissect down in the pelvic connective tissue after the ligation of the uterine vessels and exposure of the ureter, then one encounters the congested veins that drain from the vagina, bladder, and uterus into the hypogastric veins. If these are injured without preliminary clamping, which happens often in spite of the greatest care, then a strong venous bleeding may take place which floods the field of operation and makes orientation difficult. The control of this bleeding is difficult, because the veins on the lateral wall of the pelvis are immovable and can tear easily if grasped with forceps. Furthermore ligatures are difficult to make in this deep and narrow surgical field and hæmostatic sutures may easily result in more bleeding from neighboring veins. All these dangers are avoided if the technique described is followed.

The reconstruction of the wound also was not so simple before.

In order to diminish the wound surface of the pelvic tissues and to prevent bladder disturbances, the peritoneum of the bladder was united to the anterior wall of the cervix and the posterior peritoneum was sutured to the posterior vaginal wall. Above these sutures the peritoneum was closed with a continuous catgut suture. The lateral wound surfaces of the pelvis have been drained with gauze and this drainage kept in for days. All this is unnecessary and may result in the opposite of what one hopes to attain. Instead of an earlier and smoother reconvalescence, a retardation and complications in the healing process may occur. The inserted gauze holds the surfaces of the wound apart, causes increased secretion and may cause a necrosis of bladder and ureter wall. Every operation should be as simple as possible, especially one that takes much time and one that has its technical difficulties and is not without danger. This is true of the simple cases, in which the carcinoma is limited to the uterus and the parametria are free, the uterus movable. In complicated cases, in which the carcinoma involves the neighboring tissues, when the uterus is fixed by pelviperitoneal adhesions or rigid and infiltrated parametria, the technical difficulties are increased and the danger of surgical interference augmented. Only the surgeon will be master of the situation who follows a rigid outline of a surgical plan that has proved to be the safest and who uses a clear anatomical dissection which will obtain ample exposures.

FROM THE CLINIC OF DR. TERRY AT UNIVERSITY OF CALIFORNIA

THE TECHNIQUE OF PARTIAL THYROIDECTOMY

By H. H. SEARLS, M.D., San Francisco

HYPERPLASIA (exophthalmic goiter) and adenoma of the thyroid are the two common types of goiter requiring surgical treatment for relief.

In operating for goiter, because of the anatomy and physiology of the thyroid, certain dangers and complications peculiar to the procedure must be constantly borne in mind. The extreme vascularity of the gland makes the management of hæmostasis an outstanding feature of the technique of resection. Hæmorrhage may occasionally reach alarming proportions. The accident of postoperative hæmorrhage, though rare, is far more serious. The resulting condition is one of extreme emergency, not alone from the loss of blood, but because of the severe pressure exerted on the trachea by the rapidly increasing hæmatoma. Because of their proximity to the posterior capsule, injury to one or both recurrent laryngeal nerves may occur with resulting hoarseness or loss of voice. A similarly close relationship may be cause for injury or removal of the parathyroids, resulting in postoperative tetany.

Nearly always in toxic goiter patients (especially those with hyperplasia), there is an exacerbation of all the signs and symptoms of hyperthyroidism for the first 48 hours following operation. In the advanced case one may even encounter here an acute delirium. More commonly evidence of the action of toxins on the myocardium is shown by auricular fibrillation, flutter, etc.

Following the lead of Dr. H. S. Plummer, all cases of hyperplasia are given 10 minims of Lugol's solution three times daily for from 7 to 10 days pre-operatively. Generally the patient is permitted to remain in bed at home during this period, entering the hospital only on the day before operation. Digitalis is administered pre-operatively only to those patients with cardiac decompensation, as evidenced by œdema, enlarged liver, etc. Other medication consists of a soporific on the evening before operation and the pre-operative hypodermic of morphine and scopolamine administered 45 minutes before the induction of anesthesia.

Local preparation consists in shaving the field of operation, cleansing with green soap and water followed by alcohol and ether, and applying a sterile dressing. In female patients, shaving may be done on the evening before operation. In male patients it should be done on the morning of operation. After anæsthesia has been induced, the field is again cleansed with alcohol, ether, and

Fig. 1. Incision developed through platysma.

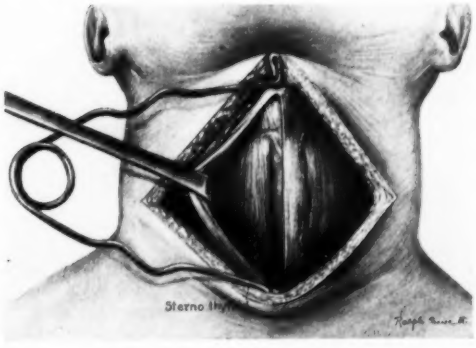

Fig. 2. Flaps dissected free. Spring retractor in place.

Fig. 3. Ligation of superior pole (hyperplasia).

an alcoholic solution of biniodid of mercury (1:1000).

While the patient is on the operating table, extension of the neck is gained by the proper placing of small pillows and folded towels. The anæsthetist obtains this position before inducing anæsthesia, being governed by the patient as to the degree of extension which can be tolerated. When there is a substernal or retrotracheal goiter, very little extension will be permitted because of compression of the trachea. The placing of the patient in the proper position on the table is of prime importance in gaining the best exposure. Nitrous oxide-oxygen anæsthesia without addition of ether and without local infiltration is used on all cases.

The true Kocher incision is employed (Fig. 1). It is from 12 to 15 centimeters in length, slightly curved, with the concavity upward, lying in the grain or fold of the skin of the neck. Its lowest point is about 3 centimeters above the suprasternal notch. It extends an equal distance on each side of the midline. It is first outlined with the point of the knife in a fold of the skin while the patient's head is flexed by the anæsthetist. If a wrinkle is present at the proper location it is utilized as the line of incision. A crossline at the midpoint is of aid in accurate closure. With the head again extended, the incision, as outlined, is developed through the subcutaneous tissues and platysma to the superficial layer of the deep cervical fascia, bleeding points being caught with small straight (Kelly) hæmostats. The upper and lower flaps are then dissected free, as high as the thyroid cartilage of the larynx and as low as the suprasternal notch, the excellent plane of cleavage between the posterior surface of the platysma and the anterior surface of the superficial layer of the deep fascia being used. A few vessels are cut in this plane, and these are ligated with No. 000 plain catgut. A wire spring retractor is then placed so as to hold the flaps apart (Fig. 2). The cervical fascia is next incised in the midline from the lower border of the thyroid cartilage to the suprasternal notch, and care is taken to avoid the anterior jugular veins. By sharp and blunt dissection the sternohyoid and sternothyroid muscles are lifted off the capsule of the gland. Very rarely, and then only in the unusually large goiters, transection of the ribbon muscles on one or even on both sides may be necessary to obtain sufficient exposure. When transection is used, the level of transection should be as near the thyroid cartilage as possible in order to preserve innervation of the muscles. With the gland exposed the operator carefully palpates both lobes and the isthmus with thumb and index finger to determine their consistency and the presence or absence

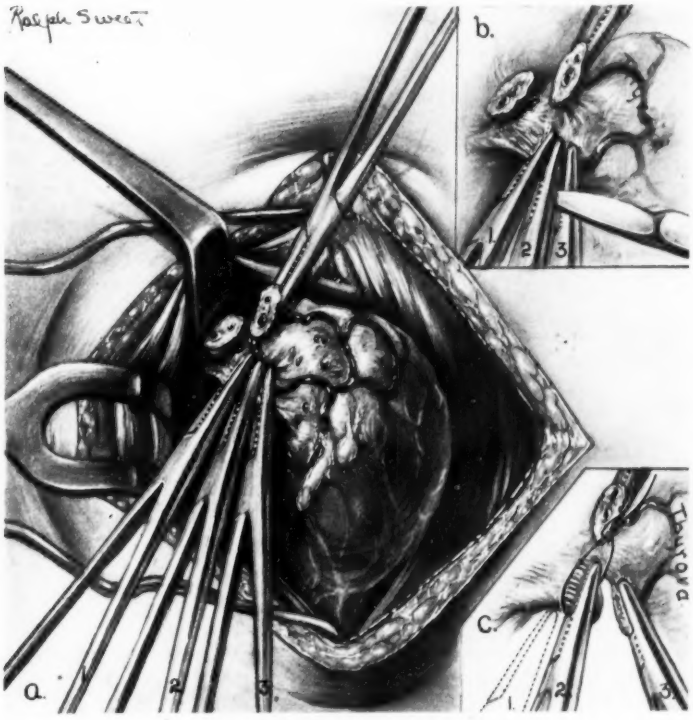

Fig. 4. Three clamp method of resection.

of adenomata. If the information thus gained does not suffice, an exploratory thyroidotomy may be performed, splitting the lobe where an adenoma is suspected and suturing it afterward.

The technical steps of the actual excision of thyroid tissue differ in the operation for hyperplasia from that for adenoma. The first step in the hyperplastic case is ligation of the superior pole. This is done with the aid of the Lahey ligature carrier, using No. 0 plain catgut, doubled (Fig. 3). The pole is then transected between clamps immediately below the ligature. Working from above downward and toward the isthmus the resection is completed using the three clamp method as illustrated (Fig. 4). A very small amount of thyroid tissue is left at the upper and lower poles and in the tracheo-œsophageal groove (Fig. 5). Permanent hæmostasis is obtained by multiple ligatures of No. 0 plain catgut tied in the groove formed by hæmostat No. 1 as shown in Figure 4, C. A similar resection, after ligation of the superior pole is carried out on the other side. As the trachea is approached, care is taken to leave a thin layer of thyroid or at least the pretracheal fascia over it (Fig. 5) to prevent postoperative tracheitis, a common complication which may develop if the outer coverings of the trachea are damaged. The capsule of the gland should be left intact posteriorly and at the upper and lower poles so as to protect the recurrent laryngeal nerves and parathyroids.

It will be noted that only the smallest calibers of plain catgut are employed—No. 000 as ligatures in the development of the wound and as sutures in the closure; No. 0 as ligatures on the gland itself. It is believed that the use of such fine catgut is of considerable importance in the healing of the wound and permits of closure without drainage. Absorption of catgut from a wound is by way of the lymphatics. If large amounts of catgut are used the lymphatics are filled with it. Drainage through the lymphatics of other wound products is then poorly handled and a marked retardation of healing results. A very large number of ligatures and sutures are employed in operating on the thyroid. An appreciable reduc-

Fig. 5. The wound after irrigation.

tion in the actual quantity of catgut used can be obtained by using the finest caliber commensurate with safety.

If the thyroid is adenomatous, the resection is somewhat altered. Superior pole ligation is used only in the larger adenomatous goiters. If a single or a small number of adenomata are encountered they may be shelled out of the thyroid, (enucleated). If many are found a partial lobectomy is planned so as to include all of the nodules. It is essential that all adenomatous tissue be removed even though a very small amount of gland proper be left. The adenoma does not supply normal thyroid secretion and cannot therefore take the place of normal gland. Failure to remove all adenomatous tissue is a common cause of recurrent goiter.

In both types of goiter, the wound is thoroughly lavaged with Ringer's solution before closing. This serves to cleanse the tissues and to demonstrate any remaining bleeding points. Suction is employed to carry away the Ringer's from the wound (Fig. 5).

Closure is made in layers, using interrupted sutures of No. 000 plain catgut. First the sternothyroids are approximated in the midline, then the sternohyoids. A third line of sutures with buried knots repairs the cervical fascia. Similar sutures with buried knots approximate the cut edges of the platysma. The skin closure is accurately made using Michel clips. Drainage is employed only in the very large goiters with substernal extension. The dressing is of folded gauze and adhesive.

The non-toxic case requires very little postoperative attention. Codein and aspirin as a powder administered 20 minutes before meals gives relief from pain caused by swallowing.

For the toxic case much can be done during the first 48 hours after operation. The so-called postoperative crisis must be met. Here the patient's temperature rises, her pulse becomes very rapid, and she is quite restless. The most important single item in postoperative care is the forcing of fluids. Hypodermoclysis and, in the more severe cases, intravenous glucose, are invaluable. To control the fever, icebags as suggested by Dr. Crile are used. In hyperplasia, Lugol's continued postoperatively is of great value in preventing a severe reaction. In advanced cases it may be administered in dilute starch solution by rectum (3 cubic centimeters of Lugol's solution in 100 cubic centimeters of starch water) while the patient is still on the table.

Postoperative complications are infrequent. Of these, tracheitis is most often seen. It is easily relieved with steam inhalations. Rarely, postoperative hæmorrhage is encountered. It demands immediate relief, for the pressure within the wound causes compression of the trachea with stridor followed rapidly by complete tracheal collapse and asphyxia. The wound must be opened at once to relieve the pressure on the trachea and the bleeding point found and ligated, after which the wound may be re-sutured with drainage.

Postoperative tetany results if several of the parathyroids are removed, injured, or lose their blood supply. It may be recognized early in its development if an attempt to elicit Chvostek's sign is routinely made on postoperative cases. Generally it is easily controlled by the protracted use of calcium bromide and lactate by mouth. The recently developed parathyroid extract, (parathormone, Lilly) is proving of great value in the more severe cases.

The patient rarely takes anything but fluids for 48 hours but usually is able to eat a fairly hearty luncheon on the second day postoperative. From then on in the toxic cases, a high calorie diet is offered, excluding tea, coffee, red meats, and extractives. The patient is given additional nourishment between meals.

In the routine case, the immediate convalescence is rapid. Clips are removed and the patient is permitted to be up in a wheel chair on the third day and leaves the hospital on the fourth day.

Prognosis differs in the two types of cases. The patient with adenomatous goiter, unless her myocardium has been badly damaged by long neglect, enjoys a rapid and complete convalescence, being able to resume her routine activities in from 2 to 6 weeks. The patient with hyperplasia, on the other hand, usually requiring from 2 to 4 months to gain complete relief. Eventually an excellent recovery is the rule.

In this clinic the following points in technique are given special emphasis:

1. Nitrous oxide-oxygen anæsthesia without adjuvant.
2. A constant endeavor to avoid unnecessary injury to tissue—atraumatic surgery.
3. Complete hæmostasis.
4. Rare transection of the ribbon muscles.
5. Plain catgut of the smallest calibers as ligatures and sutures.
6. Wound lavage before closure.
7. Closure without drainage.
8. Careful anatomical closure in layers.

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FROM THE CLINIC OF THE SANTA CASA DE MISERICORDIA

THE TECHNIQUE OF APPENDECTOMY

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IN appendicitis there is more danger from the disease than from operation, for the right kind of anæsthesia and careful technique make the latter absolutely safe.

But the danger from anæsthesia is not to be underestimated, chiefly from general anæsthesia, as in the majority of cases the patients are intoxicated. In patients with intense intoxication, advanced nephritis, emphysematous heart disease, and lung disease, we prefer infiltration of the field of operation with a solution of ½ per cent novocain-serum-adrenalin or spinal anæsthesia with 7 to 10 centigrams of novocain dissolved in cerebrospinal fluid.

In patients susceptible to suggestion and with not a very thick panniculus adiposus, infiltration is preferable as it is the least harmful of all methods of anæsthesia. Except under these conditions we habitually use ether anæsthesia given with an Ombredanne mask, preceded by ethyl chloride to shorten the period of excitement. Whenever possible the patient is purged before operation or given an evacuating enema the evening before and a diet of sweetened liquid until the operation. Whether the appendicitis is acute or chronic we determine the functional value of the liver and kidneys beforehand and also the exact topography of the cæcum and the presence of any exudates. Accurate diagnosis and good technique are the chief means of eliminating danger in the operation. X-rays, palpation, light percussion, and a careful history are the best helps in making a diagnosis.

If the cæcum, movable or not, descends to the iliac fossa, as it ordinarily does, we use a technique similar to that of McBurney which will be described in detail in this article; if the cæcum is in some other part of the abdomen the incision should be made there, as the appendix is the chief focus of inflammation and this is the only way of finding the portion of the intestine to which it is attached.

We make a longitudinal incision in the skin, 4 to 9 centimeters long depending on the thickness of the subcutaneous layer of fat, 3 centimeters inward from the right anterior superior spine of the ilium. The middle of the incision thus cuts a horizontal line which passes through this spine. With the index finger wrapped in a compress we dissect the skin from the aponeurosis of the external oblique. As it retracts, the hæmorrhage stops, and only occasionally we have to apply one or two hæmostatic forceps. The sterile compresses are then brought up to the edge of the wound where they are fixed with tenaculum forceps.

With a guarded Péan's forceps (Fig. 1a) we cut in the direction of the fibers of the aponeurosis of the external oblique, exposing the internal oblique which, with the aponeurosis of the transverse, will be cut with the same forceps.

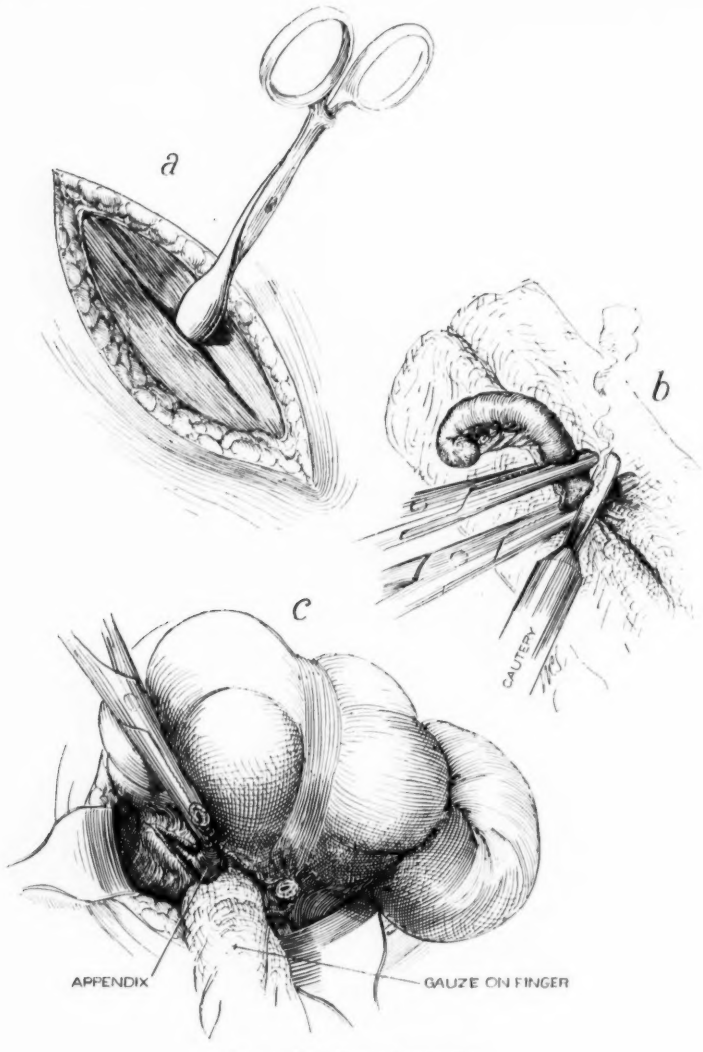

Fig. 1. Technique of operation.

The tissues being retracted the peritoneum appears, lined with the fatty subperitoneal tissue, the œdematous appearance of which, in acute cases, shows the presence of exudate or peritoneal adhesions. With the greatest care a fold of peritoneum is lifted up and incised with short incisions, 6 millimeters long, from the fixation forceps until a cavity or an adherent organ is encountered. After the peritoneum is opened in cases of phlegmonous appendicitis with defensive adhesions or abscess, the adhesions must be freed in the direction of the wall of the iliac fossa in order to approach from the outside the inflamed appendix or the abscess within whose wall it is found, more or less destroyed by the suppuration. In cases of chronic appendicitis we retract the wound immediately with Gosset's small automatic retractor, grasp the omentum or small intestine to one

side of the midline if they present, and deep down on the wall of the iliac fossa find the ascending colon, recognizable by its opaque whitish color and by its longitudinal band. Following this part of the intestine from above downward we necessarily come to the cæcum and therefore to the appendix. If this manipulation fails, as may happen in case of movable cæcum, a loop of ileum may be grasped and followed up to its insertion into the large intestine, where the cæcum is found and a few millimeters lower the base of the appendix.

Keeping the cæcum in sight we come to the lower end of the longitudinal band where the appendix is found, free, involved in adhesions, or hidden between the folds of the mesocæcum. If it is free it is ligated and the meso-appendix cut, the base of the appendix is crushed, ligated, and extirpated with the thermocautery (Fig. 1b) and the stump buried by means of a purse-string suture or Lembert's sutures. If it is involved in adhesions, it is dissected free from base to tip or from tip to base, providing for hæmostasis at the same time by means of forceps for which ligatures will be substituted later. If it is hidden between the folds of the mesocæcum the peritoneum is incised, beginning with the lower end of the upper longitudinal band, freed from the intestine at the base of the appendix (Fig. 1c) and the appendix is dissected free with the finger wrapped in gauze.

In acute appendicitis accompanied by peritonitis, after the appendix is extirpated, the focus is irrigated with ether, drains covered with gauze inserted, and all covered with compresses of aseptic gauze fastened with American adhesive plaster. If there are no adhesions which isolate the focus, one of the drains should pass into the retrovesical space and the other along the ascending colon on its external side to the subhepatic space. In the absence of peritonitis the abdomen is completely closed by four layers of sutures: (1) one layer is continuous with the peritoneum; (2) one or two separate sutures bring together the fibers of the internal oblique and transverse; (3) one layer is continuous with the aponeurosis of the external oblique; and (4) Michel's clamps are used for the skin. Catgut is used for all ligatures and sutures except those of the skin.

The patient is put in bed and the nurse stays with him for 3 hours. If he is quiet with good pulse and normal temperature nothing is done except to give small doses of fresh water to mitigate his thirst, increasing the amounts progressively to maintain diuresis. At the end of the second day, sweetened tea is given and from the third day liquid diet. On the fourth day a purgative is given and on the seventh day the clamps are removed.

The vomiting caused by the anæsthetic stops spontaneously when the intoxication is slight, but if it is extreme, insulin in progressive doses should be given and if the stomach is full of liquid which has flowed back from the duodenum it should be emptied with a tube and washed. Intoxication followed by extensive fatty degeneration of the liver is beyond medical aid.

Rapid pulse with decreased tension, when it is due to lack of water because of repeated vomiting or copious sweating, yields promptly to the giving of liquids by mouth, by the Murphy method, or intravenously. Rapid pulse caused by myocarditis can be cured only by remedies capable of overcoming the infection and intoxication which have caused it (colloids, vaccines, serums, etc.)

In case of painful meteorism, an evacuating rectal tube may be introduced, or the ice-bag and pituitrin may be used. We should never be in a hurry to open the abdomen when, soon after an operation for appendicitis complicated with peritonitis, signs of occlusion manifest themselves; for these, being the result of intestinal paralysis caused by the inflammation usually recede with the latter, and another operation under these circumstances is almost always fatal. If the surgeon is obliged to operate while such symptoms are serious, operation should be limited to fixing and opening a dilated loop of intestine under local infiltration anæsthesia. If the patient is then given disintoxicating treatment a more serious operation may be avoided.

Operation is also contra-indicated when a fæcal fistula develops on the second to sixth day, because ordinarily the fistula closes spontaneously and so only rarely requires late operation.

SUMMARY

Operation in appendicitis presents no dangers which are inherent in the operation itself. Resources are available which make it perfectly safe. The seriousness of its complications have materially decreased with the latest discoveries in anæsthesia and therapeutics.

THE EARLY DIAGNOSIS OF ANENCEPHALUS

By JAMES T. CASE, M.D., F.A.C.S., Battle Creek, Michigan
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EVEN before the onset of labor the careful obstetrician will suspect the presence of a fetal monstrosity when there are deviations from the normal findings on physical examination of the expectant mother. Nevertheless the actual definite diagnosis of the fetal abnormality before birth has rarely been accomplished even since the introduction of the X-ray into medical diagnostics.

The rounded shape of the normal fetal head is conspicuously absent in anencephaly, although the roentgen films may show distinctly the spinal bones, the ribs, and the bones of the face and base of the skull. In 1916, one of us (4) reported a case successfully diagnosed as an anencephalic before birth, the conclusion being based upon the roentgen appearances. He at that time believed this to be a unique case, for a careful search of the literature failed to disclose a report of a similar instance, and in the 10 years which have passed since that report no others antedating this case have been found by the few writers who have touched upon this subject.

It is a matter of some satisfaction to us that we are now permitted to bring before the same society which heard our first communication, a report on our further experience in the diagnosis of this particular fetal monstrosity. We now have 5 additional cases of anencephalus to report, 3 of which were successfully recognized before the onset of labor and the diagnosis in each verified by roentgen examination. These, together with the case reported in 1916, bring our total of cases successfully diagnosed before the onset of labor to 4, the roentgenograms of which will be presented in slides. In the other 2 cases, the patients were brought into the hospital late in labor and there was no opportunity for careful study. These five cases were encountered among the 1,621 obstetrical patients handled by the maternity department of the Battle Creek Sanitarium during the last 10 years. Excepting the 2 patients who were brought in late in labor, there has been no undiagnosed case of anencephalus in our clinic since 1915. In 4 cases successfully diagnosed (including the 1 published in 1916) the abnormal condition has been recognized before the onset of labor and the delivery brought about prematurely on the strength of the prenatal findings. All 4 cases were sent to the roentgen department to determine why it seemed impossible to make out the fetal head, or to determine the life or death of the fetus.

Case 1. (1916.) iii-para. The first 2 births had been normal in every respect, and the early months of the present pregnancy had been uneventful. Fetal movements were felt at the usual time, but the attending physician was unable to make out the fetal heart sounds. The placental sounds were loud and the amniotic fluid seemed excessive; it was thought that these two factors might have prevented detection of the fetal heart sounds. Another month passed, yet, in spite of prolonged and repeated efforts, no fetal heart sounds could be detected. The abdomen was as large as one would expect at term. The fetal movements, which had been felt normally for several weeks, disappeared, the patient attributing the disappearance of movements to a fall.

On external examination it was difficult to make up one's mind whether there was a head or breech presentation. On vaginal examination one palpated what seemed to be the breech. Fetal heart sounds and movements continued absent. X-ray examination to determine the position of the fetus and to explain the absence of movement was suggested. The outline of the fetus in the roentgenogram proved to be much smaller than one would expect considering the size of the abdomen. Although the bones about the face and the base of the skull, the spinal bones, the pelvic and long bones were all very distinct, in fact, unusually prominent, the cranial bones were notable by their absence.

The diagnosis was anencephalus; hydramnios death of fetus. The diagnosis of death of fetus was based upon the persistent absence of fetal heart sounds, cessation of fetal movements, cessation of growth as determined by external measurements and by comparison of roentgenograms, increased density of the fetal bones. In this case, milk had never appeared in the breasts at any time. Repeated tests of the urine and blood failed to show any abnormal findings. At operation, the hydramnios was verified and a macerated but anencephalic fetus was extracted. This patient has borne several healthy children since.

Case 2. (1924.) iii-para. The patient had had 2 miscarriages, one at 4 weeks and one at 10 weeks, and had no living children. The Wassermann reaction was negative. The patient presented herself May 14, 1924, for obstetrical examination at about the eighth month. She felt fairly well except for pyrosis and occasional low abdominal pain. The fetal heart sounds were not definitely heard, but were thought to be present. The head was not present. Breech presentation was suspected, but the head was not satisfactorily made out. She was referred to the X-ray department for examination because the presentation could not be determined; and the amniotic fluid was excessive. The

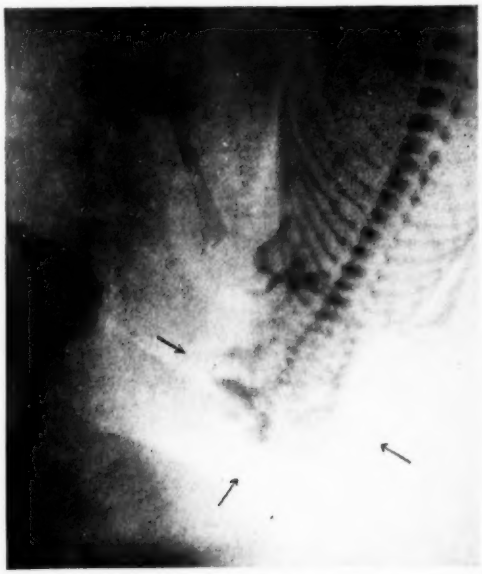

Fig. 1. A typical case of anencephaly. Lateral roentgenogram.

abdomen was very large for the duration of the pregnancy. Hydramnios was evident. Roentgen examination showed the skeletal outlines of the fetus to be complete except for the cranial bones. The bones of the face and base of skull were made out, but the cranial vault was conspicuously absent. The diagnosis was anencephalic monstrosity; hydramnios; cephalic presentation. Three days later the patient was delivered of an anencephalus with complete spina bifida.

CASE 3. (1924.) iii-para. The patient presented herself for obstetrical examination on April 20, 1924. She had 2 normal children; both deliveries had been normal. Apparently there was now a cephalic presentation. Fetal heart sounds could be heard on the left below the umbilicus. On re-examination May 19, it was thought that the head was high in the right side. The uterus appeared to be of unusual size, indicating hydramnios. The patient complained of pain in the lower abdomen. On account of difference in previous findings, a re-examination was made on June 2. Fetal heart tones were normal. The uterine fundus pressed tightly against the ensiform process. The head was not palpable. It was decidedly a case of hydramnios. The case was referred for X-ray study for further information. Roentgen findings: Examination showed a fetal abnormality, anencephalus; hydramnios; cephalic presentation; no engagement. The uterus was emptied of anencephalus; and the diagnosis of hydramnios confirmed.

CASE 4. (1925.) iii-para. Obstetrical examination at about the third month showed no abnormalities. There was nothing unusual about the case until November 3, when, upon examination, the uterus seemed to be of a size indicating full term, although from her history it appeared that she was only 7 months pregnant. She complained of lower abdominal pains suggesting labor contractions. The head could not be palpated, although fetal heart sounds were audible on the left side. Vaginal examination disclosed a slight dilatation of the cervix through which with one finger it was possible to feel what were thought to be the rough edges of a fetal head abnormality. The patient was sent to the roentgen department with a tentative diagnosis of anencephaly. Roentgen examination showed cephalic presentation of an anencephalic monstrosity; hydramnios. Premature delivery was brought about, with recovery of the acranial fetus.

Fig. 2. Anencephalic fetus of Figure 1.

THE DIAGNOSIS OF ANENCEPHALUS

Negri (9) in 1889 laid down the specific physical signs of anencephaly on the basis of 2 cases in which he suspected the diagnosis before birth. By careful palpation the faulty character of the cranium was recognized and there were convulsive movements of the presenting part and limbs. In one case the fetus was dead before delivery.

Viana (13) reports 2 cases. In one, in spite of hydramnios, it was possible to produce convulsive movements of the presenting part and limbs of the fetus by palpation alone, and on this data he made a probable diagnosis of anencephalus

Fig. 3. Roentgenogram of fetus shown in Figure 2. The spina bifida was recognized from the roentgenogram.

Fig. 4. Anteroposterior study of Case 3.

which was later verified. In the second case, in the eighth month a diagnosis was made of a probable morphological alteration of the fetal head. Pregnancy was interrupted and a 1,400 gram anencephalous fetus removed.

Lautaigne (8) in 1883, gave the signs for diagnosis of anencephaly as follows: Considerable volume of abdomen; tension of uterus; hydramnios; exaggerated spasmodic movements of fetus (exaggerated as regards intensity, situation and coordination in relation to normal fetal movements.

Lautaigne quotes Pinard's rule: (1) Permanent exaggerated tension of uterus; (2) difficulty in finding fetal poles; (3) difficulty in identifying fetal head; (4) convulsive movements of fetus. In addition, Lautaigne suggests an auscultatory sign; viz., weak fetal heart sounds. He also suggests that by the examining finger it is possible to determine easy and exaggerated "ballottement" and to feel presentation anomalies (see our Case 4).

Lascano (7) recognized *intra vitam* a case of anencephaly from the physical exploration through the cervix alone. The case was verified. Thoms (12) and Ballard (2) each report a case of anencephaly diagnosed *intra vitam* at the beginning of labor from the physical findings of the examining finger *per vaginam*. The diagnosis was verified in both instances.

Giglio (6) refers to some of the characteristics of these monsters which may lead to certain diagnosis not only in pregnancy but in labor. His signs of probable anencephaly are: "The existence of polydramnios; serous infiltration of the subcutaneous tissue or the anasarcous aspect of the patient; thickening of the skin on the mons veneris and vicinity; presence and fugitiveness of traces of albumin in the urine; disordered fetal movements; syphilitic history, etc."

The most favorable time for the physical diagnosis of anencephaly is at the beginning of labor. By digital exploration and digital touching of the presenting part, the form and volume may sometimes permit recognition of an anencephalus when the cephalic extremity presents. The diagnosis becomes easier as dilatation proceeds. Suggestive signs are smallness of the presenting head, absolute absence of the cranial aspect, and the fact that at a certain degree of uterine dilatation the descent of the cephalic extremity into the birth canal occurs.

Giglio also discusses abnormality of the fetal heart sound. This is always weak and uncertain, he says, because the cardiac muscle, although apparently physiologically formed and sufficiently

nourished, is lacking in innervation for its function because the cerebral and even spinal centers may not be developed.

VALUE OF THE ROENTGEN EXAMINATION

The foregoing brief summary includes all the physical signs which have been offered upon which to base a diagnosis of anencephalus; yet, most of them are indecisive except after the stage when the onset of labor permits the introduction of an examining finger into the cervical canal. It is a pity to permit the mother of an anencephalous monster to carry the fetus after it has become possible to make a definite diagnosis; yet toward this object the physical signs available before the onset of labor permit only a conjecture, at the best.

Now that the obstetrician may utilize the roentgen-rays in his work, without any fear of doing damage to either mother or child, it seems reasonable to invoke this aid in every case in which any doubt exists as to the location or normality of the fetal head. Anencephalic monsters are usually associated with more or less deviation from the normal course of pregnancy. It is with some pride that the authors relate these 4 cases recognized positively before the onset of labor, and point to the fact that in the last 11 years, in a series of nearly two thousand consecutive labors, the only cases of anencephaly which have not been recognized before the onset of labor were 2 brought into the hospital and seen for the first time long after labor had commenced.

Technique of the roentgen examination. Films may be exposed with the patient lying on the side and lying prone upon the film. In the latter instance, it is a simple matter to place pillows under the hips and chest in order to prevent undue pressure upon the distended abdomen. Intensifying screens are invariably employed to reduce the time of the exposure. The results are much more satisfactory now that the diaphragm first conceived by Bucky, but not at all practicable, has been perfected by Potter, of Chicago. By the employment of fine-focus tubes, double intensifying screens with films, and the Potter-Bucky diaphragm, excellent roentgenograms are easily obtainable, even with a bedside X-ray equipment.

Interpretation of roentgen findings. The abnormal development of the base of the skull with small orbital cavities, absence of sella turcica, absence of cranial bones, and more or less extensive spina bifida afford opportunity for prenatal recognition of anencephalus in the roentgenogram. Normally the rounded outline of the cranial vault is the most conspicuous part of the unborn fetus

Fig. 5. Anteroposterior study of Case 4.

on the roentgen film; in anencephaly the bones of the face and base of the skull cast a shadow rather more dense than usual, the rounded outline of the cranial bones being conspicuously missing. In one of our cases a spina bifida was plainly seen, though the first in the literature to make mention of this finding is Doub (5). In reviewing our cases, we are able now to recognize the spina bifida in the roentgenograms of another of our cases. In the future, this should be one of the objectives to be attained in the roentgen study of these cases.

The first case of anencephaly recognized roentgenologically before the onset of labor was reported by Case (4) in 1917, in a paper read in 1916 before this society. Since that time there have been an increasing number of reports of this condition. Campbell and Willetts (3) in discussing the value of the X-ray in obstetrics cite a case of anencephaly recognized before the onset of labor. Menees was associated with the authors in their work. Spangler (11) reported 2 cases successfully diagnosed before labor set in, with the result that pregnancy was terminated early and the mother spared the many trials of continuing pregnancy and the chagrin of delivering a monster at term. Anderson (1), co-operating with Menees, reports 2 cases in which anencephaly was roentgenologically proved before the onset of labor. In one of these patients there were twins and it was recognized that one of them was anencephalous. The other twin was born alive and is in good health.

Even after the onset of labor there may be a use for the X-ray examination, as shown by the case of Rudolph (10).

SUMMARY

1. Four cases are reported in which the diagnosis of anencephaly was made before the beginning of labor. In each case the diagnosis was based upon atypical physical findings plus the proof furnished by the roentgenogram, and verified by operation.

2. These four instances represent all the cases of anencephalus which entered this clinic prior to the onset of labor (since 1915). Two other patients who were not seen until labor was well advanced were found with anencephaly, but the diagnosis was already evident from the appearance of the presenting deformed head when the patients were first seen.

3. A brief review of the literature shows that without the roentgen examination it is possible to do no more than conjecture the presence of anencephaly. It is therefore, reasonable to urge a routine roentgen study of all obstetrical cases presenting hydramnios, when there is difficulty in identification of the fetal poles, or when the fetal heart sounds are weak or uncertain. With the aid of the X-ray it is possible to state definitely whether or not there exists an anencephalus.

4. There is given a brief review of the cases of anencephaly thus far reported in the literature, successfully recognized before the onset of labor.

5. Anencephaly represents only a relatively small proportion of fetal monstrosities, and the monstrosities represent only a small part of the field of usefulness of the roentgen-ray in obstetrical practice.

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DISCUSSION

Dr. W. C. Danforth: Dr. Case has given us an interesting and practical exposition of the subject. The X-ray can be a very valuable aid in the diagnosis of anencephalus. A patient recently came under my care at 7 months because of a rapid increase in the size of the uterus. She had an acute hydramnion which caused me to suspect the possibility of an abnormality of the fetus. X-ray plates showed very clearly the absence of the cranial vault. I have brought the plates with me for your inspection. Labor was induced and an anencephalic fetus delivered. Three or four years ago this same patient was under the care of another member of this society for a similar condition. Diagnosis at that time was also made by X-ray.

Dr. Carl H. Davis, Milwaukee: Since locating in Milwaukee I have delivered two patients of anencephalic monsters. In one there was some question as to whether she had an anencephalic monster or a placenta ahead of the head. The X-ray showed it was an anencephalic monster.

This brings up a very important point, namely, in cases of breech presentation in which cæsarean section may be considered, it is well to take an X-ray to determine whether the head is normal before going ahead with the operation. Out of six anencephalic monsters which I have delivered, four have presented by the breech.

Dr. C. S. Bacon: The importance of determining the presence of anencephalic monsters in pregnancy comes up particularly when we have to decide whether in the presence of hydramnios the fetus is normal or not, because in the first case we wish to carry on the pregnancy in spite of the discomfort to the patient, whereas in the case of a monster it is a loss of time, to say the least, and a great deal of discomfort to the patient to have her go on to term. I recall one patient, over 30 years old, who was extremely anxious for a child. Along about the twenty-sixth week of her pregnancy she became distended and suffered considerably. There were uterine contractions and on account of her great anxiety for a baby I kept her under drugs to a certain extent to control the contractions of the uterus. I continued the treatment for several weeks until finally she was delivered of a monster. The next time she became pregnant she went through the same history except that I did not keep her in bed so long and she was delivered the second time of an anencephalic monster. Then in spite of my advice that she should give up trying to have a family, she became pregnant a third time and was delivered of a monster.

The point I want to make is that this procedure advocated by Dr. Case is of a good deal of importance in the differential diagnosis between hydramnios from whatever cause it may be with a fairly normal child and a monster.

Dr. Irving F. Stein: I think a word of warning should be sounded on the interpretation of the film in the diagnosis of an anencephalic monster and hydramnios. Much depends upon the position in

which the patient is placed when the film is taken. We have many instances where pictures taken in the lateral, dorsal, and prone positions do not visualize the skull bones. In the pressure of hydramnios when the fetus is difficult to portray, it is hard to make a differentiation between a normal and abnormal fetus. We have hesitated very much about being too dogmatic in the interpretation of the films of suspected monsters. In one instance we thought from the pictures taken in the lateral and dorsal positions that the fetus had hydrocephalus but later the patient was delivered of a normal baby with a normal head. Again, in a case of breech, or dorsal view the skull bones were not visible on the film and we suspected an anencephalus. However, upon obtaining a film in the prone posture, the head was visualized and appeared normal.

Dr. N. S. Heaney: At the time of Dr. Case's first paper before this Society, I reported also a case of anencephalus, which, though not diagnosed in full detail, was, nevertheless, definitely determined to have a marked deformity of the head. This patient had a marked hydramnios and upon the basis of the X-ray examination the treatment to prevent premature labor was stopped and the patient promptly went into labor and gave birth to the monster.

I was interested in hearing about the case of spina bifida of Dr. Case because I did an elective cæsarean section this last year and was chagrined to deliver a child with a spina bifida in the cervical region. In every case of elective cæsarean section we have a preliminary X-ray examination to rule out possible monstrosities. We were not able to find anything the matter with this child's skeleton and were unprepared for a child with spina bifida. Perhaps the deformity is not great enough to show by the means we have yet at hand.

Recently, we had a patient under attention whom we did not wish to go past term. Examination made preliminary to a proposed induction of labor showed a very small presenting head, not larger than would be expected in a 6 or 7 months fetus. X-ray examination showed that the skull was perfect in outline but extremely small, while the rest of the skeleton was of normal appearance. We had not met this appearance on the X-ray plate before and were not certain enough to make an absolute diagnosis but suspected that we were dealing with a fetus exencephalus. The patient was allowed to go into labor spontaneously and the fetus was one in which the brain lay outside of the cranial cavity.

Dr. John E. Cooper, Battle Creek, Michigan. The main diagnostic feature of these cases is the polyhydramnios. The polyhydramnios develops in almost all cases within 2 or 3 weeks. In the cases in which the condition comes on quickly and ballottement is present, we feel that we are dealing with an abnormality of the fetus and have an X-ray examination made. It usually occurs in the seventh month or following that. By ballottement of the fetus we mean a too free movement of the whole fetus in the abdomen.

Dr. J. T. Case, Battle Creek (closing): I remember very well that 10 years ago when I reported the first case of anencephaly discovered by the X-rays before the onset of labor, Dr. DeLee mentioned that the history of these patients was important for he had observed that anencephalus tended to repeat. That is why I mentioned in the notes of my first case that the patient had since the birth of the anencephalus given birth to two normal children.

Dr. Bacon's case is especially interesting in this connection.

All five of our cases were cephalic presentations.

The chance of error in interpretation referred to by Dr. Stein is important. Only today I learned of a case here in Chicago in which the patient had been suspected of having an anencephalus, this opinion being based upon the anteroposterior radiological examination. Further confirmation was desired however, and a lateral roentgenogram was made, showing a perfectly normal cranial vault. This is a very important warning and one which we should bear in mind.

Of course the field of roentgenology in obstetrics is very broad. I have been particularly interested in the last 2 or 3 years in hearing about the development of an obstetrical roentgenological center in Paris. They have taken a great deal of interest in it and have accomplished a great deal. They naturally take the viewpoint that the radiologist must be an obstetrician in order to appreciate what they are trying to find. No doubt they will work out something valuable.

EXPLORATION OF THE CEREBELLUM

By E. B. TOWNE, M.D., San Francisco
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THE operation of cerebellar exploration has undergone a gradual evolution in this clinic during the past six years. The earlier technique was that of Cushing[1], in which we used general anæsthesia and the cross-bow incision. At the present time, the operation is done with local anæsthesia, through a long midline incision. In a few recent cases, a gliomatous cyst has been tapped through a small trephine opening, and exploration has been postponed until the patient has made the maximum improvement resulting from relief of the internal hydrocephalus. The present technique lessens hæmorrhage and intracranial pressure, shortens the period of convalescence, restores the neck to a normal condition, and decreases the operative risk.

Anæsthesia. Procaine-adrenin anæsthesia has been used since 1919 for all operations on the brain, unless contra-indicated by the age or the mentality of the patient. It reduces to a minimum two major difficulties of intracranial surgery, hæmorrhage and the increased cerebral pressure of etherization. The "shock" of such operations is practically eliminated. The patient's cardiac rate and blood pressure show little if any change during operation. There is rarely any postoperative vomiting. Operating on a conscious patient certainly imposes an increased strain on the surgeon, but the fact that an operator who once tries local rarely goes back to general anæsthesia for intracranial work is the best evidence that it is worth while.

Infiltration of the extracranial soft parts is satisfactory for operations on the cerebrum, but not for exploration of the cerebellum, because the large posterior cervical muscles require so much solution. Direct blocking of the upper cervical nerves is a better method. The lateral oblique route described by Meeker and Hundling[2] has proved to be the best, as it eliminates the danger of injury of the vertebral vessels or of puncture of the dura. It gives an anæsthesia limited above by the distribution of the fifth cranial nerve, and it may be carried downward as far as is desirable. For the incision described below, injection on the transverse processes down to and including the fifth cervical is sufficient. About 3 ounces of 1 per cent procaine, containing not more than 20 drops of adrenin, are required.

Incision. Cushing's cross-bow incision gives a perfect exposure of both cerebellar hemispheres. The only objection to it is the necessity of immobilizing the patient's head for 10 days, in order to be sure that the cut muscles heal soundly. The incision to be described has been used for some time by Dr. H. C. Naffziger of San Francisco. It extends from a point 4 inches above the external occipital protuberance to the tip of the fourth cervical spinous process, keeping strictly in the midline. The scalp is freed laterally from the epicranial aponeurosis and from the fascia of the cervical muscles for a distance of 2 or 3 inches. The muscles are detached from the laminæ of the upper cervical vertebræ, and from the occipital bone up to the superior curved line and as far as the mastoid processes. By proper retraction and change of the position of the head, the craniotomy, the incision of the

[1] Cushing, Harvey. Tumors of the Nervus Acusticus and the Syndrome of the Cerebellopontile Angle. Philadelphia and London: W. B. Saunders Company, 1917.

Fig. 1. Photograph of the scar of the midline incision.

[2] Meeker, W. R., and Hundling, H. W. Local anæsthesia in operations on the neck. Surg., Gynec. & Obst., 1924, xxxviii, 806.

dura, and the intradural work can be carried out as easily as through the cross-bow incision. An excellent exposure of the cerebellopontile angle is obtained. More room may be gained by short transverse incisions in the fascia; but this step has never been necessary. [1]As no muscle fibers are cut across, immobilization of the neck is not required. The postoperative period is therefore more comfortable, and the wounds are invariably strong.

The following case illustrates the value of the anæsthesia and of the incision.

W. McG., a man aged 32 years, was seen in July, 1925, complaining of headache, dizziness, loss of visual acuity, double vision, vomiting, and loss of 40 pounds in weight. Examination showed high grade choking of the optic disks, nystagmus, an unsteady gait deviating to the left, ataxia more marked in the right arm and leg, and slight central type weakness of the left face. August 5, the upper cervical nerves were blocked with 90 cubic centimeters of 1 per cent procaine containing 15 drops of adrenin. The cerebellar hemispheres were exposed after tapping the posterior horn of the right lateral ventricle. The right hemisphere was larger and softer than the left. A blunt aspirating cannula entered a cyst 1 centimeter below the surface of the right hemisphere, and evacuated 30 cubic centimeters of yellow fluid which coagulated at once. At the end of operation the patient's cardiac rate was 90 per minute, and his blood pressure had dropped only five points. He made an excellent recovery. Figure 1 shows the scar. In November, 1925, he had gained 30 pounds in weight and was free from symptoms, except for occasional attacks of dizziness. Examination showed nothing abnormal except slight nystagmus on looking to the right. The optic discs and the visual acuity were normal, the facial weakness was gone, there was no headache or ataxia, and the gait was normal.

Preliminary evacuation of a cyst. The advantages of this procedure are illustrated by the following case, in which it was first used as the result of a mistaken diagnosis of abscess of the brain.

C. L., a schoolboy aged 12 years, referred by Dr. Constantine Bricca, of San Francisco, was seen in October, 1924, complaining of headache, dizziness, double vision, and vomiting. In 1910 he had a pulmonary abscess, followed by pyæmia. Examination showed choked discs measuring 7 diopters, weakness of the left sixth nerve, central type weakness of the left face, slight weakness of the right arm and leg, and increased tendon reflexes and pathological great toe signs on the right. There was no nystagmus, ataxia, or dysmetria. He was too prostrated to attempt to stand. He was flushed, drowsy, and often irrational. There was a positive Kernig sign, more marked on the right side. The temperature was normal, the cardiac rate 70, and the leucocytic count 15,000. The ears and nasal sinuses showed no evidence of infection. The preliminary diagnosis was a lesion of the left frontal lobe, possibly an abscess. October 24, under general anæsthesia, the left frontal lobe was explored with a blunt aspirating cannula through a small trephine opening. The cannula entered a dilated ventricle at a depth of 2.5 centimeters. The diagnosis was changed to a lesion of the right cerebellar hemisphere, possibly an abscess, causing an internal hydrocephalus. October 29, the right cerebellar hemisphere was explored through a trephine opening in the angle between the mastoid process and the lateral sinus. At a depth of 3 centimeters the cannula entered a gliomatous cyst, and evacuated 25 cubic centimeters of yellow fluid, which coagulated immediately. The symptoms and signs of internal hydrocephalus cleared up rapidly. When he left the hospital, November 21, the swelling of the optic discs measured less than 2 diopters, and he was walking steadily on a rather wide base. He gained rapidly in weight and strength. December 29, he was beginning to complain of headache, and to vomit occasionally. The optic discs showed a slight recurrence of swelling, after having been practically normal for 2 weeks. January 7 and 12, 1925, under general anæsthesia, a two-stage exploration of the cerebellum was done through a midline incision. The tumor involved the middle and right lobes. The presenting wall was 1 centimeter in thickness. The diameter of the cystic cavity was about 4 centimeters. Microscopic examination of the excised posterior wall of the tumor showed degenerating glioma. The patient made a good recovery and left hospital February 8. Roentgen-ray treatments were given once a month up to June. At the present time, December, 1925, the boy appears to be entirely normal, without any demonstrable sign of cerebellar disease. He plays actively and does well in school.[2]

This experience brought up the question of deliberately using this procedure in certain selected cases of cerebellar tumor. Martin[3] has analyzed Dr. Cushing's material, consisting of 95 verified cystic gliomata and gliomatous cysts, representing 30 per cent of the gliomata in his series. Fifty-four and seven-tenths per cent of the "gliomes cavitaires" were in the cerebellum. If one eliminates tumors of the cerebellopontile angle, which are usually localized without difficulty, there is a good chance that other tumors of the cerebellum may be cystic. If, in such a case, the patient's condition is precarious because of advanced internal hydrocephalus, preliminary aspiration may be carried out with little or no risk, and with a reasonable prospect of relieving internal hydrocephalus and decreasing the risk of the subsequent major operation. It has happened that cysts were found in both the other patients on whom a preliminary cannula exploration was done. In both instances the patient came to exploratory operation in vastly improved condition.

Elsberg[4] has recently proposed the same procedure for tumors of the cerebrum, "with the hope and belief that it will materially diminish the number of useless major operations for supra-

[1] Since this article was written, a successful intracapsular enucleation of an eighth nerve tumor has been done with local anæsthesia. Although the exposure through the midline incision was satisfactory, the tumor lay so deep that it was found best to cut the fascia and muscle on one side to a point halfway between midline and mastoid process.

[2] Both patients, W. McG. and C. L., were well in June, 1926.

[3] Martin, Paul. Le traitement chirurgical des gliomes cavitaires de l'encéphale. Arch. Franco-Belges de chir., 1923, xxvi, 807.

[4] Elsberg, Charles A. Problems in the diagnosis and treatment of infiltrating tumors of the cerebral hemispheres with remarks on a new surgical procedure. Am. J. M. Sc., 1925, clxx, 324.

tentorial new-growths, and that by this means the indications for operative interference will not only become more clearly defined but also that the results of the surgery of tumors of the brain will be improved by the exclusion of surgically hopeless intracranial disease." Dr. Elsberg says nothing about cerebellar tumors. In this clinic, cannula exploration through a small trephine hole is restricted to infratentorial lesions, unless the presence of an abscess cannot be ruled out, in which case the cerebrum is similarly explored. If a cerebral lesion is certainly a tumor, and if the history and findings suggest a glioma, we do a subtemporal decompression and evacuate a cyst, if one is found, through this opening. If the presence of a glioma is not proved, or if an enucleable tumor is found, an osteoplastic flap operation is done after an interval of time. With glioma verified, roentgen-ray treatment is started. Cases 1, 2, and 5 of a recent report[1] are examples in point. This method avoids useless osteoplastic explorations and provides the necessary decompression. Our aim in using cannula exploration through a small trephine opening is therefore quite different from Dr. Elsberg's, in that we hope to evacuate a cerebellar cyst and temporarily relieve the pressure on the aqueduct of Sylvius which has produced an internal hydrocephalus.

[1]Towne, E. B. Roentgen-ray treatment of tumors of the brain. J. Am. M. Ass., 1925, lxxxiv, 1813.

SUMMARY

In the development of the technique of exploration of the cerebellum, three procedures have proved to be of value.

1. The use of local rather than general anæsthesia has lessened the operative risk by reducing hæmorrhage and intracranial pressure. Blocking of the upper cervical nerves by the superior oblique route of Meeker and Hundling is the best method.

2. Replacement of the cross-bow incision by a midline incision has eliminated bulky dressings, increased the patient's comfort, shortened the period of convalescence, and given uniformly strong scars.

3. Temporary relief of internal hydrocephalus by aspiration of fluid from a gliomatous cyst of the cerebellum through a small trephine opening has, in a few selected cases, greatly improved the patient's condition and made him a better surgical risk for the exploratory operation, postponed until the appearance of the first signs of recurrence of the hydrocephalus.

A FLEXIBLE-KNEE TRACTION SPLINT FOR THE LOWER LIMB

By KENELM H. DIGBY, M.B., B.S., F.R.C.S., Hongkong, China
Ho Tung Professor of Clinical Surgery, and Professor of Surgery, University of Hongkong

So many types of splints have been recorded for the treatment of fractures of the shaft of the femur that one hesitates to describe another. But the very number of methods adopted suggests that the ideal piece of apparatus has not, so far, been devised. This paper describes a splint which embodies certain modifications which seem to be of advantage.

There is no doubt that the general practitioner who undertakes the treatment of a fractured femur does so with considerable anxiety. Of course it is easy to say that all fractures of the femur should be treated in hospitals or even in special femur hospitals with elaborate apparatus and care. But often enough this is impracticable. It can also be said that a fractured femur should be treated by open operation and the fragments accurately fixed with plates and screws. But the operation is a severe one and not advisable in all cases. And perfect as the results are, yet it is doubtful whether an operation not entirely free from risk should be undertaken if good length and alignment can be secured by conservative measures. Indeed we would advise an open operation only when the condition is not satisfactory after at least one week of conservative treatment. Moreover the very special skill required for plating fractures aseptically is not always at hand.

The principal excuse for describing the present splint, then, is that it provides a simple and very comfortable apparatus ready for use, which secures results as good as those obtained by more complicated apparatus for conservative treatment in special hospitals with specially trained staffs.

PRINCIPLES EMBODIED IN THE SPLINT

A flexible joint for the leg piece. One cause of delayed recovery after fracture of the shaft of the femur is knee stiffness. During the Great War it was found that by attaching a hinged leg piece to Thomas's splint (the Thomas splint being suspended and pulled on by weights on the Hodgen principle) the knee could be flexed and extended daily and the stiffness of the knee could be avoided. Pearson used this method in association with his non-penetrating ice-tong calipers with great success.

If this flexible leg piece is employed with the usual adhesive strapping applied to the leg instead of Pearson's ice-tong calipers it soon becomes apparent that as the degree of flexion approaches a right angle the adhesive strapping becomes loose and all the traction force comes to be borne directly on the back of the calf at right angles to the surface (Fig. 1).

In the splint about to be described we take advantage of the idea of applying traction[1] by pressure on the back of the calf as well as by (or alternately to) friction on the skin surface by adhesive strapping. The splint can however be used conveniently in association with direct skeletal traction by ice-tong calipers or transfixation pins if so desired, and is also extremely useful when the fragments of the femur have been plated at open operation.

The Hodgen type of frame with introduction of a telescopic principle. After extensive trials with various experimental apparatus we find the Hodgen type of frame preferable to the Thomas. The close encircling ring of the latter is liable to produce blisters even when a traction weight is employed. This is particularly true in a tropical climate, where also the padded Thomas ring is too hot and the padding is liable to become infected with vermin.

To prevent any pulling of the frame down from the hip as the limb lengthens we secure the upper end around the waist of the patient, who is sitting up, by webbing and a buckle covered with rubber tubing. And, in order that traction at the site of the fracture may not be interfered with, the telescopic principle is introduced.

A nearly horizontal position for the thigh. By keeping the thigh as nearly horizontal as possible, the weight used in maintaining traction is employed entirely to that end and not exerted in raising or supporting the lower limbs. One of the great difficulties in conservative treatment of fractures of the femur is the application of sufficient weight traction without damage to the tissues at the point of application. By employing the traction force to raise the limb as well as to exert pull in the long axis of the thigh, one is needlessly increasing this difficulty.

A footplate. With the thigh more or less horizontal and the leg nearly vertical it becomes nec-

[1] The word "traction" is much better than the more commonly used "extension," which is liable to cause confusion with regard to the position of the adjacent joints.

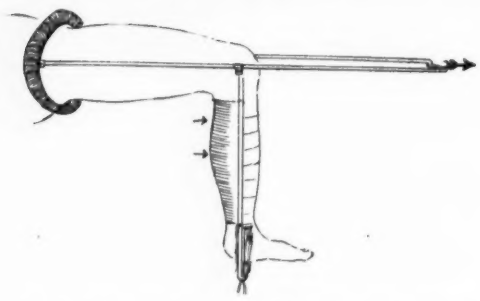

Fig. 1. When the knee is forced to a right angle, traction force in the long axis of a Thomas splint bears directly on the back of the calf.

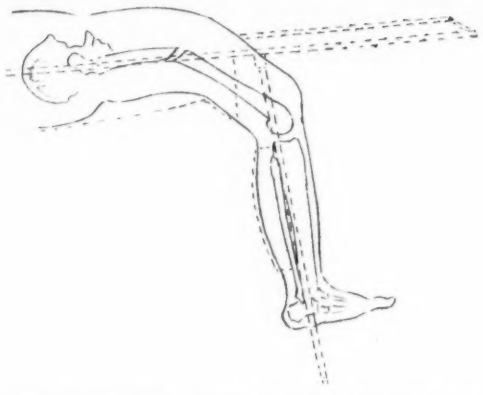

Fig. 2. When the knee is flexed to a right angle, the foot, leg, and lower fragment of the femur sag downward This illustrates the need for a foot plate.

essary to provide a footplate. Otherwise in the case, for instance, of a fracture below the middle of the shaft of the femur, the weight of the part of the thigh with the lower fragment, of the leg and of the foot have all to be supported by the flannel thigh sling below the site of the fracture. This part of the flannel sling then tends to cut into the back of the thigh just above the bend of the knee. There is also a tendency to tilt the proximal end of the lower fragment forward (Fig. 2).

A single point of suspension. By suspending the limb in a case of fracture of a long bone we aim at securing fixation of the fragments without absolutely checking movement of the proximal and distal joints. The frame supported limb must be so freely and so delicately balanced that the proximal end follows any excursion of the pelvis or any movement imparted to any part of the splint with practically no resistance. If the frame supported limb is suspended at more than one point, even if so suspended by equipoise weights, this is not fully obtained, for the pelvis may not only move up and down but also from side to side.

Even in the method here advocated, the attachment of the cord bearing the traction weight interferes slightly with the principle of a single suspending cord at the center of balance. But if the cord is accurately in the line of the splint frame and if there is a good length of cord between the end of the frame and the pulley, the defect is only a slight one.

After the use of plates and screws, no traction is needed and the ideal of a single point of suspension is completely realized.

A sitting up position for the patient. This is of enormous advantage in elderly people, in whom prolonged recumbency involves risk of lung trouble and bedsores. Patients at all ages find the sitting posture pleasanter in the day time during the long period of inaction. The patient soon accommodates himself to sleeping in a sitting position. The use of the bed pan is greatly facilitated.

The best mean position for the adjacent joints. Some range of movement is aimed at in the adjacent hip and knee joints as very desirable. At the same time for each joint certain positions may be regarded as favorable, and these should be the average or mean positions occupied during healing.

There are several considerations to guide us in determining the best mean positions.

1. In order that the minimum traction weight may be employed, the maximum relaxation of the muscles must be secured. This is done by placing each joint at the mid-point of the normal range of each of its movements.

The principal movement at the hip joint is about a transverse axis and has a range of some 160 degrees when the hamstrings are relaxed by flexion of the knee joint. The hip should be flexed from the so-called anatomical position through about 80 degrees. With the hip so flexed abduction is much freer than adduction: abduction can now take place to 80 degrees, adduction only to 10. Hence abduction to 35 degrees is the mid-position giving the maximum relaxation. With hip flexed 80 degrees and abducted 35 degrees lateral rotation takes place through 35 and medial rotation takes place through 15 degrees.

Therefore the hip should be flexed 80 degrees, abducted 35, and laterally rotated 10.

Fig. 3. Showing the muscles which are lacerated in a fracture of the shaft of the femur.

The only movement at the knee joint that needs to be considered is that of flexion about a transverse axis through about 160 degrees.

The "mean position" of the knee-joint is thus flexion through 80 degrees from the "anatomical position."

2. A second consideration is that to prevent subsequent stiffness of the adjacent joints, we must rather stretch those muscles which are especially bruised and lacerated at the time of the fracture. In the case of the femur the three vasti muscles suffer most damage, and next to them the adductor group (Fig. 3). This is well seen in postmortem examinations of cases with recent fracture of the femur. The vasti muscles extend the knee-joint. Hence we have an additional reason for flexing the knee-joint. Indeed we should from this point of view feel inclined to increase the flexion beyond a right angle. When the femur is treated in an extended or only very slightly flexed position, the lacerated muscles cicatrize in that position with resulting contracture and stiffness of the knee. As they lie too far from the bone, the hamstrings which flex the knee are seldom lacerated, with the exception of the short head of the biceps. Moreover the vasti muscles enwrap the shaft of the femur and if taut play a useful part in holding the parts in apposition.

The adductor muscles adduct and laterally rotate the hip-joint. We are therefore encouraged to abduct the hip-joint from the anatomical position, but from this point of view slight medial is preferable to lateral rotation.

3. When the fracture is near either extremity of the femur the generally recognized principle must be observed that the longer fragment must be brought into alignment with the smaller and less controllable one.

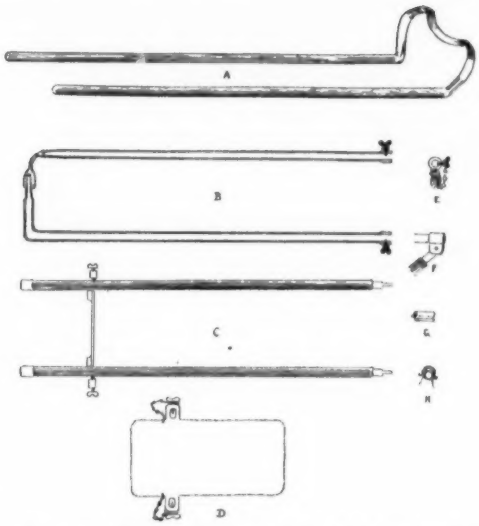

Fig. 4. Diagram of the parts of the flexible knee traction splint. (× ¼.) A, Thigh piece; B, fixed leg piece, C, movable parts; D, foot plate; E, hinge in section; F, hinge from side; G, clip; H, clip in section holding flannel.

If the fracture of the femur is immediately below the greater trochanter the upper short fragment receives the insertion of flexors but not of extensors of the hip-joint and all the abductors and medial rotators and only some of their antagonists. Hence the upper fragment is flexed, abducted, and medially rotated to a slight degree and the lower fragment with the whole limb must be brought into line with it.

On the other hand if the fracture is so low as to lie immediately above the origin of the gastrocnemius the lower fragment has flexors of the knee-joint but not extensors attached to it and therefore assumes a position of very considerable flexion. The knee may therefore then require to be flexed to more than a right angle to restore the correct alignment.

Fortunately the considerations named point for the most part in the same direction:

The hip and knee are each flexed nearly to a right angle and the hip is abducted 35 degrees.

If the fracture is very high up the flexion and the abduction of the hip-joint should be augmented to a certain extent, and if the fracture is very low down the flexion of the knee-joint should be increased.

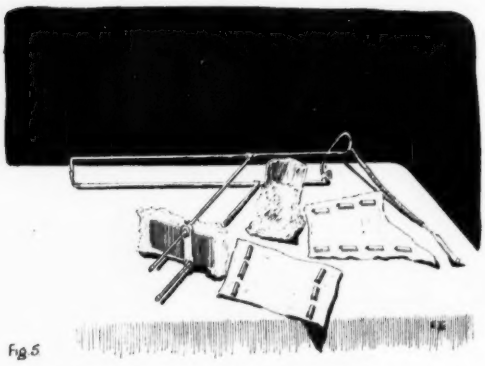

Fig. 5. The flexible knee traction splint for the lower limb showing wool over the foot plate, poroplastic and wool for the calf and flannels, and clips for the leg and thigh; also waist webbing enclosed in rubber tubing.

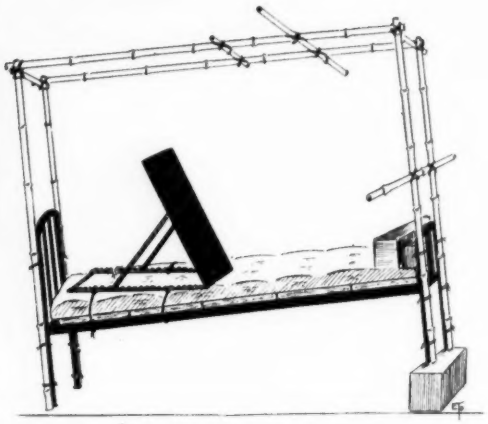

Fig. 6. Ordinary bed adapted for treating a case of fractured femur showing the bamboo four-poster with three cross poles, the foot rest, the obliquely placed back-rest, the raised foot of the bed, and the fracture boards beneath the mattress.

With regard to rotation it is probably best to adhere to the anatomical position and it may be pointed out that with this splint the anatomical position is secured when the leg is placed vertically.

Adjustability. The splint should be easily adjustable so that it will accurately fit either right or left lower limb at almost any age. This feature is especially valuable to the small hospital and to the general practitioner in outlying districts who may have to treat fracture patients in their own homes. The splint to be described now has been fitted to a boy of 8 years and to a man of 6 feet 2 inches in height.

Non-slipping of supporting flannels. Owing to the fine longitudinal grooves on the rods of the splints, the metal clips hold the flannel supports of thigh and leg so securely that there is absolutely no slipping through of the flannel. If any such "give" were to take place the splint would soon cease to be properly adjusted.

SPECIFICATIONS OF THE SPLINT

The splint (Figs. 4 and 5) consists of 1 thigh piece A; 1 fixed leg piece B; 2 movable leg parts C; and 1 foot plate D.

B, C, and D cannot be separated in the assembled splint.

The thigh piece is made up of two nearly parallel rods each 2 feet 3 inches long and ½ inch in diameter. Each is scored by fine longitudinal grooves 1/20 inch across with 1/20 inch interval, that is, 10 grooves to the inch. The proximal ends of these rods are connected by a specially shaped and arched bar, 17 inches in length, capable of being bent a little in all planes by hand.

The fixed leg piece comprises two nearly parallel tubes connected distally by a transverse part. The tubes are each 2 feet long and have an external diameter of ⅝ inch and an internal diameter or lumen of just over ½ inch. These tubes thus receive the rods of the thigh piece permitting them to slide easily. The distal transverse part is 5 inches in length. It presents an annular constriction in the middle. It is joined to one of the parallel tubes by a rigid rectangular bend; at the junction with the other the tube is hammered flat for several inches and is bent in a curve forming one-quarter of the circumference of a circle. It is capable of being easily opened a little or closed a little by hand. The proximal open ends of the tubes are each thickened by a collar which is prolonged below into two flanges to provide attachment for the hinge pin upon which one of the movable leg parts moves.

Each movable leg part is 2 feet in length and ½ inch in diameter. It is scored by fine longitudinal grooves 10 to the inch. The proximal end is flattened from side to side and perforated for the corresponding hinge pin of the fixed leg piece. The hinge joint should work somewhat loosely. The distal extremity is thickened so that the foot piece is prevented from ever becoming detached.

The foot plate is 3/16 inch thick, 4½ inches wide, and 10 inches in length. The edges are deeply milled. On its under surface is a transverse strip 1 inch wide. This is placed 2½ inches from one (the posterior) end and 6½ inches from the other (the anterior) end. At each side the transverse

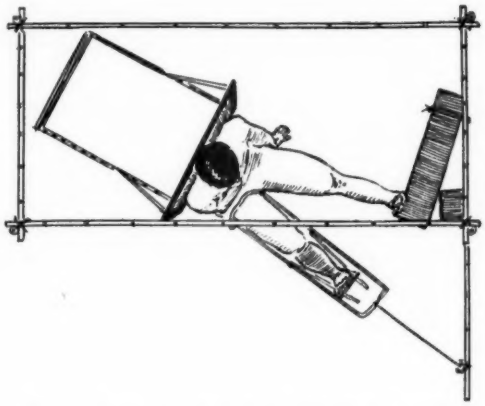

Fig. 7. Bird's eye view of ordinary bed adapted for treating a case of fractured femur. This shows 30 degrees abduction of the hip-joint and the oblique position of back rest and patient; the leg clears the side of the bed.

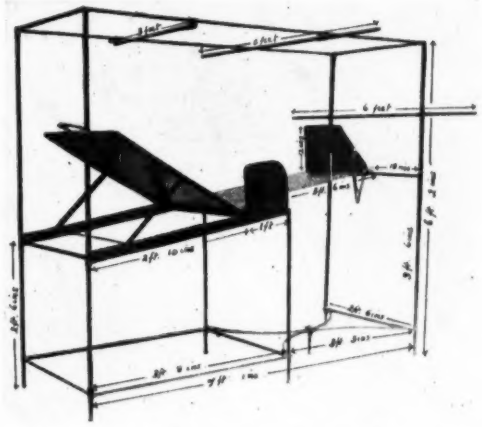

Fig. 8. Special bed for treatment of cases of fractured femur. The pieces of iron on which the sections of mattress rest should be perforated for ventilation. The perforations are not shown in the figure. A non-detachable crank handle at the foot of the bed for adjusting the position of the foot plate has also been adopted as an improvement since the photograph was made.

strip projects 1¼ inches beyond the foot plate where it thickens to one half of an inch and is perforated by a transversely oval opening (½ inch by ¾ inch) which receives the corresponding movable leg part. A winged screw (attached by a ring and chain to the foot plate to prevent it ever being lost) is capable of being tightened to fix the foot plate firmly at any point to a movable leg part.

Each splint is provided with a score of clips. Each clip is 2 inches long. In section it presents two-thirds of the circumference of a circle (having a diameter of half an inch) with rolled back edges which are filed smooth at the ends. The clip is highly tempered. It fits the longitudinally scored rods of the thigh piece and of each movable leg part quite loosely until a layer of household flannel is interposed when it will be found that the flannel is held sufficiently firmly against the sharp grooves so as to preclude all possibility of slipping. Each clip is pierced by a small hole so that the clips can be kept strung on a line when not in use.

This splint has been made for me most excellently by Messrs. Down Brothers (London) and by the Taikoo Dockyard, Hongkong. The splint has been made both in brass (silver plated) and also in duralumin. The former only should be employed as the splint is then more conveniently balanced.

PREPARATION OF BED FOR A CASE OF FRACTURED FEMUR

We have designed a special type of bed for use with this splint which is here briefly described and illustrated. Any ordinary bed can, however, easily be employed by converting it into a four-poster by means of bamboo or other poles, by using a sandbag or box for the foot plate and by using an ordinary back rest. The latter may be placed somewhat obliquely to enable the leg of the abducted limb to clear the side of the bed more easily. The foot of the bed should be raised one foot in height and fracture boards must be placed beneath the mattress (Figs. 6 and 7).

Our special bed is a skeleton four poster of tubular iron (Fig. 8). The part on which the patient rests consists of 3 pieces of iron namely (1)a back rest (2 feet 10 inches long) which can be raised and fixed anywhere up to 90 degrees; (2) a transverse strip (1 foot broad) on which the patient sits and (3) a longitudinal strip (3 feet 6 inches long) for the uninjured lower limb. All these slope upward toward the foot of the bed (1 foot in 7 feet 1 inch). Sectional mattresses corresponding to these are required.

A pelvic plate can be attached to the transverse "sitting" strip to keep the patient from sliding off the bed and a foot plate is fixed to the longitudinal "lower limb" piece, so that the patient can keep himself up in bed by kicking the sole of his sound limb against it.

The side frame of the bed is interrupted opposite the lower limb piece so that the splint will not knock against the bed even if the abduction of the hip is very slight. In order to maintain the stability of the bed, two middle legs are used and

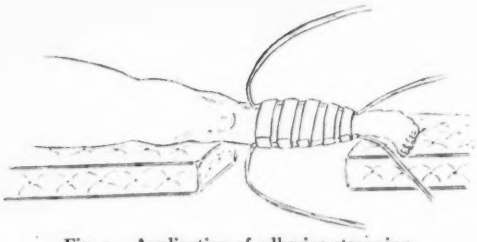

Fig. 9. Application of adhesive strapping.

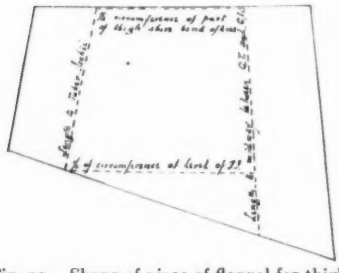

Fig. 10. Shape of piece of flannel for thigh.

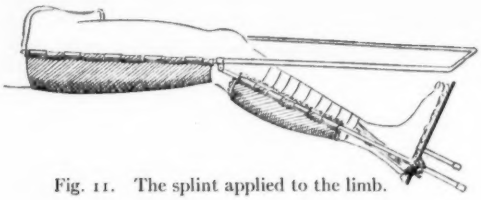

Fig. 11. The splint applied to the limb.

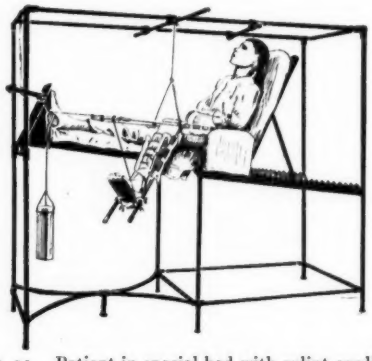

Fig. 12. Patient in special bed with splint applied.

the side bars in the lower part of the bed replaced by a framework near the floor.

The patient can raise himself by holding a transverse tube above him and the splint is suspended from a long cross piece while the pulley over which the weight acts is attached to a third long tube at the end of the bed. These tubes are adjustable by means of rectangular tubular crosses, there being no loose parts to be mislaid, and the adjustment requiring no spanners or other instruments.

METHOD OF APPLICATION OF THE SPLINT

To secure uniform results with any piece of apparatus a strict technique must be followed. The rules which are issued to our dressers in charge of these cases are therefore appended.

Administer ¼ grain morphine.

X-ray the fracture while the first-aid splint is still on.

Place the patient on the femur bed. The sectional mattresses should have been arranged so as to leave a gap opposite where the leg will lie (Fig. 9).

Apply the adhesive legging. Shave the leg if it is hairy. Cut two strips of adhesive zinc oxide strapping, 2 inches wide, as long as from below the head of the fibula to 3 inches above the malleoli. Sew both ends of each to pieces of stout 2 inch bandage. Apply the strapping to the medial and lateral sides of the leg. Envelop the leg with encircling strips, the ends of each of which cross over lateral vertical strip. Apply a roller bandage without knots or pins. The bandage ends attached to the vertical strips of adhesive are now lying loose. There is an upper and a lower bandage on each side.

Adjust the splint to the limb. Make the splint sufficiently wide for the thigh and the knee. Adjust the splint to the affected side by making the lateral rod of the thigh piece longer than the medial rod. Adjust the foot plate so that the distance from the foot plate to the hinge equals the distance from the level of the middle of the patella to the sole of the foot. Measure suitable shapes of household flannel to fit the thigh (Fig. 10) and leg. Place a suitably shaped and sized piece of poroplastic (two thirds of circumference of wool encased leg) lined with two layers of white wool behind the calf and clip the flannel pieces to the longitudinally ridged rods. The upper bandage from the adhesive should lie *outside* the poroplastic. Raise the back rest and secure the rubber covered webbing and buckle it around the patient's waist. Tie the upper and lower bandages from the adhesive on the medial side to those on the lateral side below the *posterior* part of the foot plate (Fig. 11).

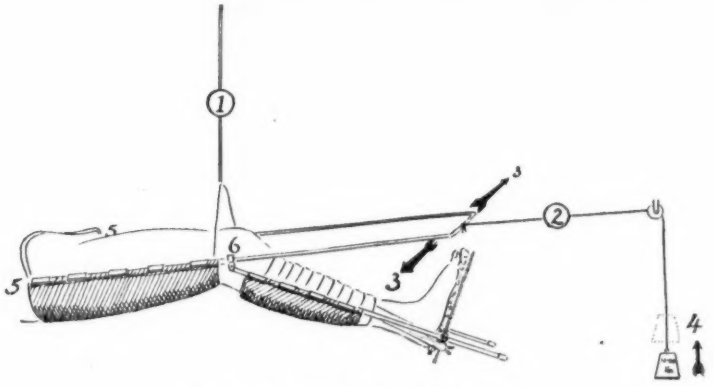

Fig. 13. Six points in regard to the splint.

Suspend the splint. Tie the appropriate movable leg rod to the cross bar of the fixed leg piece close to the right angle. Apply a short loop of cord to the rods of the thigh piece close to the hinge of the knee piece. The knots should be bowlines. At the middle of the loop attach another cord by a bowline. The other end is secured to the suspension bar of the special bed by means of a clove hitch. The splint should be nearly horizontal but with a slight inclination upward of the distal end.

Apply the traction. A weight of 10 to 20 pounds is attached to a cord which passes through a pulley on the pulley bar of the bed to the groove on the cross bar of the fixed leg piece. The pulley should abduct the hip-joint 30 degrees.

Final adjustments of the bed. A pelvic guard plate should be inserted on the fracture side of the bed. The leg plate on the fractured side should be removed. The foot rest should be adjusted so that with the patient close to the bed rest and the knee straight, the foot touches the foot rest (Fig. 12).

Every day the dresser must methodically check the following points.

In regard to the splint (Fig. 13):

1. The suspension cord must be vertical.
2. There must be plenty of room between the end of the splint and the pulley.
3. The whole limb must swing freely and painlessly from the hip joint.
4. When the traction weight is lifted the splint must not tilt.
5. The medial rod of the thigh piece must reach to the tuber ischii.

The lateral rod of the thigh piece must reach just below the tubercle of the iliac crest.

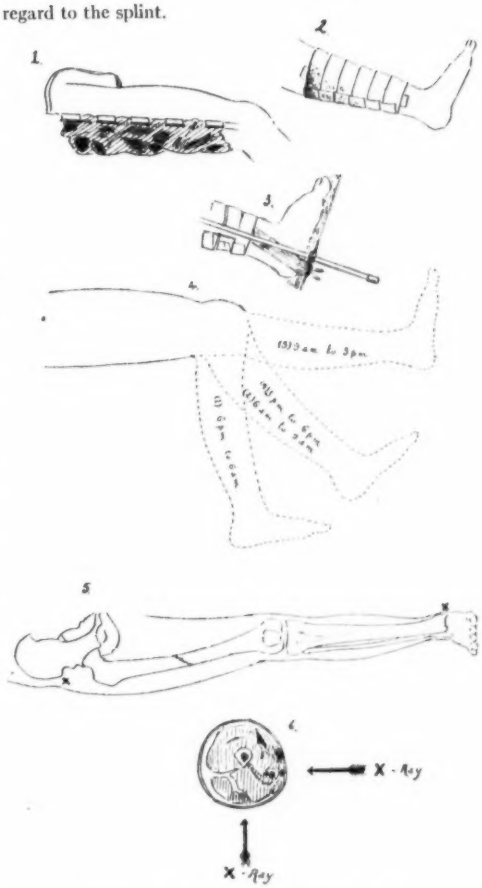

Fig. 14. Six points in regard to the limb.

6. The axes of the knee and knee-flexion hinge joints must correspond.

In regard to the limb (Fig. 14):

1. There must be no wrinkles in the supporting flannel.

2. There must be no weeping sores beneath the adhesive strapping.

3. There must be no excessive puffiness of the foot.

4. The position of the knee must be changed during the 24 hours, for instance, 6 p. m. to 6 a. m., flexed 90 degrees; 6 a. m. to 9 a. m., flexed 45 degrees; 9 a. m. to 3 p. m., fully extended; 3 p. m. to 6 p. m., flexed 45 degrees.

5. The length must be charted daily, anterior-superior-spine to the medial malleolus, and compared to the opposite limb, knees being extended and hips in corresponding positions.

6. During the first week and during the sixth week, roentgenograms in two planes at right angles should be taken. A portable X-ray apparatus for this purpose will usually be unobtainable except in hospitals. If however there is no shortening and the general alignment of the limb is good the lack of the X-ray is of less consequence.

THE TYPE OF CASE SUITABLE FOR TREATMENT WITH THIS SPLINT

The splint is used in this clinic for all fractures of the shaft of the femur including those at the upper and lower ends. With the latter, that is, supracondyloid fractures, manipulation under anæsthesia may be necessary to disimpact the fragments. In these cases too the knee may have to be flexed well beyond a right angle and if this is done, the front of the leg instead of the calf must be supported with flannel and the traction force comes to press directly upon the sole of the foot through the foot plate.

The splint is also very useful for the so-called extracapsular and intracapsular fractures of the neck of the femur. With the former, disimpaction under an anæsthetic is usually necessary. For the latter the hip joint is abducted to an extreme degree, and we have succeeded in obtaining bony union at an advanced age after 8 weeks in the splint.

The majority of our cases of fractured femur do well with less than half an inch of shortening and free movements at hip and knee-joint. But if at the end of a week's careful splinting the alignment is bad or there is more than half an inch shortening, further operative measures should be considered. After the fragments have been fixed at open operation the splint is employed without traction by weight and pulley which is no longer necessary.

I am indebted to Dr. S. H. To for the care and skill he has expended on the illustrations, and to many of my house surgeons and dressers for their assistance in developing this splint, and also to Messrs. Down Brothers of London, The Taikoo Dockyard, and the engineering workshops at the Hongkong University for assistance in working out details.

CLOSED DRAINAGE IN SUBPHRENIC ABSCESS

Report of Two Cases

By JOHN D. McEACHERN, M.D., F.A.C.S., Winnipeg, Manitoba

SUBPHRENIC abscess is one of the most serious conditions that the surgeon is called upon to treat. A perusal of the literature on the subject shows that about one-third of patients operated on and more than three-quarters of patients not operated upon die from the affection. Moreover, in the patients who do recover after operation the convalescence is often greatly prolonged and the final result unsatisfactory.

Because of the delay in diagnosis many of these patients, when surgical treatment is undertaken, are exceedingly ill, being worn out from prolonged sepsis. They are, therefore, poor surgical risks.

Except in the unusual cases in which the abscess has become so superficial that it can be opened through an abdominal incision without entering the general abdominal cavity, the operation generally practiced for a right sided subphrenic abscess has been the transpleural one, with resection of the eighth, ninth, or tenth ribs. This is a surgical procedure of considerable magnitude and in extremely weak patients will carry a high operative mortality.

The diaphragm in these cases is pushed up on the affected side sometimes as high as the third or fourth rib, with resulting lung collapse. The abdominal viscera are frequently greatly displaced and fixed in their new position by inflammatory reaction. After open drainage, the abscess cavity, on account of the rigid nature of its walls, may drain for months before it is obliterated. During this long period of suppuration, there is a decided tendency for the drainage opening to close before healing is completed. In subphrenic abscess, therefore, we have a condition presenting difficulties of treatment in many respects allied to empyema, and it was on account of success in the treatment of this latter malady by closed drain-

Fig. 1. Case 1. Showing elevation of diaphragm on the right side. The double headed arrows indicate the area containing gas beneath the diaphragm.

Fig. 2. Case 1. Roentgenogram taken with the patient on the left side, showing the position of the fluid level with the gas above.

Fig. 3. Case 1. Showing deformed duodenal cap.

age, in conjunction with irrigation of the cavity with Dakin's solution, which led me to adopt the method described here in subphrenic abscess.

By this method drainage is established with a minimum amount of shock to the patient. Under local anæsthesia the tube is inserted into the abscess cavity through a trocar, if necessary without removing the patient from bed. By the use of Dakin's solution the rigid walls of the abscess cavity are softened, and the infection overcome. With the assistance of negative pressure, the collapsed lung expands, the diaphragm returns to its normal level, and the approximated walls of the abscess obliterates the cavity.

The following two cases of subphrenic abscess have been treated in this way with satisfactory results.

Case 1. Right sided subphrenic abscess following perforation of duodenal ulcer, treated by closed drainage with cure.

Mr. —, aged 31, was admitted to hospital on June 3, 1923, complaining of pain in the epigastrium, shortness of breath, and profuse sweating. His temperature on admission was 102 F., pulse 120, leucocyte count 27,800.

Ten days previous to admission to the hospital the patient while resting quietly after his usual evening meal developed a severe pain in the abdomen. He called his family doctor, who kept him in bed under observation until his admission to the hospital. During this week at home the pain continued but was not so severe as at first. He ran an afternoon temperature as high as 102 F., and had profuse sweats. The day before admission a fullness was noticed in the epigastrium and he developed some difficulty in breathing.

Patient has always been in excellent health until 2 years ago, when he began to complain of "stomach trouble." Since then he has had periodic spells of discomfort and pain after meals, and has been troubled a good deal with gas and sour eructations. Six months ago he had an attack of pain in the abdomen which doubled him up. He was 3 days in bed at this time, the pain gradually wearing away.

Physical findings. When I first saw the patient on June 7, 2 weeks after the onset of the illness, there was a marked swelling in the right epigastric region. The left border of this swelling extended from the ensiform cartilage to the umbilicus. The lower border was not so definite and extending outward from the umbilicus was lost before it reached the costal margin. With the patient lying prone the percussion note was tympanitic over the bulging area. There was moderate tenderness on palpation. With the patient in the same position there was an apparent increase in liver dullness, upward, extending to a point on a level with the fifth rib in the mid-axillary line. Anteriorly this dullness ended abruptly at the level of the anterior axillary line. In front of this the percussion note was tympanitic. Over this affected area, partly tympanitic and partly dull, breath sounds were absent. A few crepitant râles could be heard above its upper border. When the patient was turned on the left side, liver dullness entirely disappeared and dullness was then found to be present in the region of the swelling in front. When the patient was placed in the sitting position the fluid level again changed, leaving a tympanitic area between the upper border of the fluid and the lung.

Examination under the fluoroscope showed the right diaphragm to be immobile and displaced upward about 3 inches (Fig. 1). With the patient on the left side the fluid level was plainly visible (Fig. 2). Roentgenograms of the stomach and duodenum after an opaque meal showed a deformed duodenal cap (Fig. 3).

A diagnosis of subphrenic abscess resulting from perforation of a duodenal ulcer was made.

Drainage. On June 9, under local anæsthesia, a trocar was passed into the abscess at a point in the posterior axillary line below the tenth rib, and 42 ounces of foul smelling pus, and a considerable quantity of gas evacuated. A small rubber tube with a terminal and a lateral eye was then passed into the abscess cavity and the trocar withdrawn. Absorbent cotton saturated with collodion was now laid in successive layers against the skin around the tube, building up a collar three-quarters of an inch in thickness and with a circumference of 5 inches. This dressing effectually sealed the opening around the tube and held it in a fixed position. A glass connection of the Y type was then attached to the tube in the abscess cavity, one end of the Y connected with the suction apparatus, and the other to a container holding Dakin's solution (Fig. 4).

Bacteriological examination of the pus showed a mixed infection of streptococcus and bacillus coli.

After-course. Beginning 48 hours later the cavity was irrigated with Dakin's solution every 3 hours during the day and two or three times at night. These irrigations gave the patient no discomfort, except some slight pain in the right shoulder, which disappeared at once as soon as some of the solution was allowed to run off. His temperature came down to normal on the third day. At the end of a week there was only a faint trace of pus in the discharge.

June 28, the cavity held 45 cubic centimeters of Dakin's solution.

July 1, the cavity held 30 cubic centimeters.

July 9, not more than 10 cubic centimeters of Dakin's solution would run in through the tube. The tube was withdrawn and a dry dressing applied.

The patient left the hospital on July 14 feeling well. Roentgenograms made at this time showed the position of the right diaphragm to be normal. There was no further discharge of pus from the tract of the tube.

The patient returned to his work as accountant in 2 weeks after leaving the hospital and has remained well.

CASE 2. Right sided subphrenic abscess following pneumococcus peritonitis, complicated by empyema; treated by closed drainage with cure.

Master —, aged 9 years, first came under my observation on January 4, 1924. He was pale, weak, and emaciated from prolonged sepsis, and complained of slight pain and tenderness along the right costal margin. Temperature 103 F., pulse 124, leucocyte count 18,900, von Pirquet reaction negative.

On September 30, 1924, while at school, he developed a severe pain in the abdomen accompanied by fever and vomiting. He soon became delirious. Four days later he was taken to a hospital, and a laparotomy was performed for peritonitis. His temperature previous to operation was 103 F., pulse 130, leucocyte count 11,500. At operation the abdomen was found filled with a thin pus containing flakes of fibrin. There was no attempt at localization. No local cause of the peritonitis could be found within the abdomen. The appendix was removed, and the abdomen drained.

Bacteriological examination of the pus revealed the pneumococcus to be the offending organism.

His condition improved somewhat after the operation, but he continued to run a septic temperature up to 102 in the afternoon. A note on the chart under date of October 14 stated that there was dullness and diminished breath sounds over the base of the right lung posteriorly.

On October 17, the upper border of this dull area had extended to the lower angle of the scapula. Pus was flowing freely from the abdominal drainage.

November 22, the dull area was described as being unchanged except that the note was somewhat flatter. The abdominal wound was still discharging. His condition remained much the same until I saw him on January 4.

Physical findings. On January 4, the upper border of the dull area in the right chest was at the level of the sixth rib in the mid-axillary line. This dull area was continuous with liver dullness below. There was no increase in liver dullness downward. There was slight tenderness on deep palpation along the left costal margin in front. Some crepitant râles could be heard along the upper border of the dull area.

Roentgenograms made January 5 show the diaphragm to be pushed up in a dome-like projection on the affected side (Fig. 5).

Operation. On January 15 a long exploratory needle was inserted below the tenth rib in the mid-axillary line, passing in an inward and upward direction. This attempt failed to locate pus and the aspiration of some dark blood indicated that the needle was in the liver. The needle was reinserted below the ninth rib with a similar result. On account of the danger of infecting the pleural cavity, it was thought advisable to explore the abdomen to get a more exact location of the abscess. The patient was anæsthetized and the abdomen opened by an incision one and a half inches in length below the ensiform cartilage. The liver was found adherent to the diaphragm along a line beginning at the edge of the falsiform ligament at the middle of the upper surface of the liver, and extending obliquely outward and downward, crossing its right surface about one and a half inches above its inferior border. This line of adhesion between liver and diaphragm was very firm, and undoubtedly formed the wall of the abscess. After considering the duration of the abscess and the density of the adhesions between liver and diaphragm, we felt reasonably certain that the visceral and parietal layers of the pleura adjacent to the abscess would be firmly adherent, and that therefore drainage could be established by puncture of the chest wall without danger of infecting the pleural cavity. With the finger in the abdomen as a guide an exploratory needle was passed through the chest wall into the abscess cavity, at what seemed to be its most dependent part, and pus obtained. This exploratory puncture was made in the eighth interspace in the posterior axillary line. After closing the incision in the abdomen, the needle was then withdrawn and a trocar passed along its tract into the abscess cavity and 8 ounces of thick pus evacuated. Through this trocar a small rubber tube was passed and the trocar withdrawn. Absorbent cotton

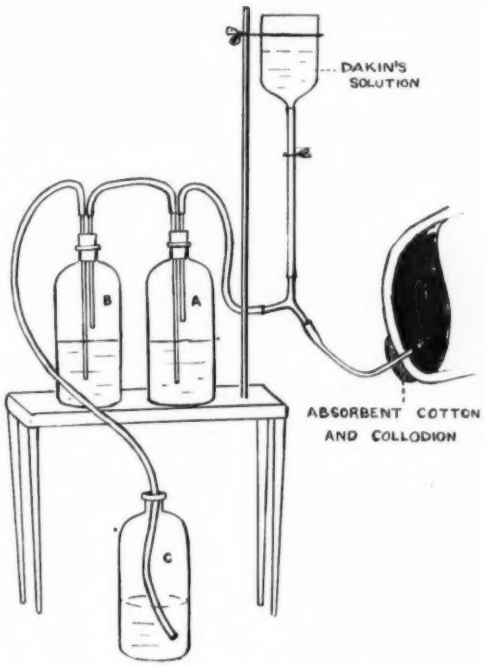

Fig. 4. Illustrating closed drainage of subphrenic abscess. To irrigate the cavity the rubber tube connecting the Y glass connection with bottle A is clamped, after which the clamp is removed from the tube connecting the Y with the container for Dakin's solution; when the abscess cavity is filled the solution is clamped off and the clamp between the Y connection and bottle A removed, allowing the solution to drain off by suction into bottle A. To remove the solution accumulated in bottle A, clamp both rubber tubes leading from the glass connections in the cork; the cork may then be withdrawn and the bottle emptied without disturbing the siphon.

Fig. 5. Case 2. Showing dome-like elevation of diaphragm on the right side.

saturated with collodion was then applied around the tube as in Case 1.

Bacteriological examination of the pus showed the pneumococcus.

After-course. Irrigations with Dakin's solution, every 4 hours during the day and twice at night, were begun 24 hours after the operation. This was later increased to every 2 hours during the day and three or four times at night. His condition improved but the temperature still kept up to 100–102 degrees F. in the afternoons.

January 25, some leakage appeared beneath the cotton and collodion dressing, which was removed and a fresh one applied. On examination the percussion note over the back was no longer flat, and breath sounds could be heard. An area of dullness was now found to be present at the base of the right lung in front. The outer limit of this dullness was slightly in front of the anterior axillary line. Between this latter point and the drainage tube the percussion note was resonant. This was interpreted as a localized collection of pus in the pleural cavity. Temperature was still up to 101. Cavity holds 4 ounces.

February 8, leakage again appeared beneath the dressing, and on inquiry it was found that suction had not been working well for 3 or 4 days. As the cavity now held less than one ounce the suction was discontinued and a very small drainage tube left in place.

February 9, a transfusion of 240 cubic centimeters whole blood was given. An exploratory puncture in the fifth interspace in the nipple line resulted in 20 cubic centimeters of pus being aspirated. The pus on examination showed the pneumococcus. The patient's general condition was much the same. The drainage tube was removed.

February 20, the dullness in the right chest in front now extends up to the upper border of the fourth rib, and laterally to the anterior axillary line. Over parts of this area bronchial breathing is heard. The percussion note over the back of the right lung is practically normal. Auscultation is normal also except for some scattered râles. The tract of tube is healed.

March 4, condition unchanged. Temperature 99–102.

March 10, a small rubber tube was inserted into the empyema through a trocar in the fifth interspace in the nipple line and 3 ounces of pus evacuated. The usual cotton collodion dressing was applied around the tube. Smear made from the pus showed the pneumococcus. Irrigations with Dakin's solution were begun in 24 hours. (Previous to this, the parents, who claimed that the child had already been subjected to several surgical procedures without apparent benefit, refused to give their consent to having the empyema drained.)

March 21, condition greatly improved, appetite good, gaining in weight.

April 3, some leakage beneath cotton and collodion dressing. Dressing removed and fresh one applied. Patient feeling quite happy, has gained about 15 pounds in weight. Irrigation with Dakin's solution continued.

April 25, cavity held 6 cubic centimeters. Suction drainage discontinued. Dry dressing applied.

May 4. Tract of tube healed.

This patient left the hospital on May 14, feeling well, and has remained well since.

I first made use of cotton and collodion as a dressing to prevent leakage around the tube in closed drainage of empyema 5 years ago. Since then I have used it many times and have found it very satisfactory. If the cotton is carefully applied in successive layers to a thickness of three-quarters of an inch, no leakage will occur for a period varying from 10 to 30 days. It has been my experience that the thickest pus and flakes of fibrin, will, with the use of Dakin's solution, soon become sufficiently liquefied to pass readily through a small tube. Should the tube become plugged, it can be freed by the injection of Dakin's solution or saline with a syringe.

In cases suitable for its application, this method of treatment of subphrenic abscess would appear from the point of view of simplicity, operative mortality, and subsequent function, to have decided advantages over the open operation. It is not without danger, of course, in cases in which the trocar must be passed through the pleura in order to enter the abscess, as one cannot always be certain that the layers of the pleura are so firmly adherent as to prevent infection of the pleural cavity. Though a localized empyema of the pleural cavity occurred in the second case here reported, the fact that the collection of pus was located at considerable distance from the puncture, and that the pleura around the tube was not involved, seems reasonable grounds for believing that it was due to an extension from the abscess, and not to infection of the pleural cavity at the site of the puncture.

The objection may be raised that, as there is sometimes more than one collection of pus present in subphrenic abscess, there is danger that drainage established by this method may be incomplete. Leaving out of consideration the cases in which the process has extended to the liver with formation of multiple abscesses which cannot be adequately drained by any operative procedure, it may be pointed out that (as a study of necropsy findings in cases of death following operation will show) secondary abscesses are not uncommonly overlooked when the open operation for drainage is performed. If the primary drainage has been established by the method described here, the patient's vitality will not have been lowered by the procedure, and a second operation—either open or closed—to afford complete drainage, may be undertaken with less likelihood of an operative death than if the first operation had been an open one. The author believes that the method will be found especially useful in those desperate cases, not uncommon, in which when surgical treatment is undertaken the patient is weak and emaciated from weeks and months of sepsis, and in which the mortality with the more formidable open operation is so high.

ASPIRATION IN THE AFTER-TREATMENT OF OPERATION OF THE URINARY BLADDER

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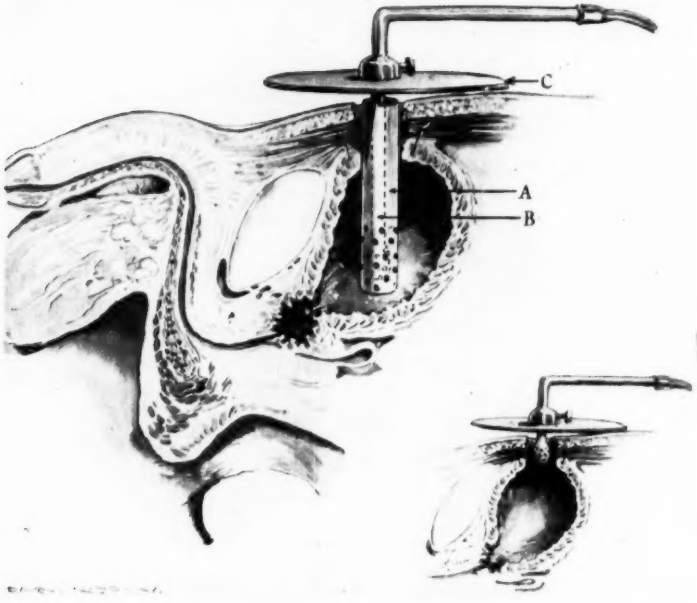
ASPIRATION in the after-treatment of operation of the urinary bladder is, of course, not new, but the mode of application of the principle has not been very satisfactory because at some time or other during the convalescence, the aspirating tube has to be removed from the bladder and the urine must then drain into dressings until the wound in the bladder closes. The scheme subsequently described was evolved in our clinic and has been in constant use for 10 years, and, from the beginning to the end of the illness, has obtained, almost without exception, a dry, clean, odorless wound.

In the senile prostatic patient with defective renal function and tissue of low vitality, drainage into dressings, the method most in vogue, is usually attended with a low infection, and this may be followed by sloughing of muscle cellulitis of the space of Retzius, ammoniacal decomposition of urine and phosphatic deposition on the wound. The unpleasant smell and a wet bed ensure a miserable convalescence. In addition to this, the bladder must always contain a residuum of urine more or less contaminated from the healing wounds. This predisposes to thrombosis of the veins in the prostatic bed or to a retrograde infection of the frequently dilated ureters. Thus, recovery is retarded in the very patient who can least afford it. Syphonage of the bladder, another system in which a tube is stitched tightly into the bladder, also permits a constant residuum and the tube may block with clots and cause a distention with urine. This is very likely to give rise to postoperative hæmorrhage in cases in which prostatectomy has been done.

In aspiration by the double bottle method, the low pressure generated cannot overcome blocking by small clots, and frequent stoppages occur; because of these, and, since it is necessary to remove the aspirating tube in order to allow the opening in the bladder to close, the wound becomes more or less wet after the removal of the tube.

The diagram illustrates the method. A large well-perforated rubber tube *A* is inserted into the bladder; in this is cut a slot as far as the opening in the bladder wall. A very small tube *B* with a perforated aspirating point is introduced into this large tube and set by means of the screw in plate *C* just a little above the base of the bladder. In 7 or 8 days, when the space of Retzius is sealed off, the aspirating point is elevated and set in the wound just ventral to the opening in the bladder wall (as in inset diagram), so that the urine is picked up just as it leaves the bladder, and the abdominal wall is protected. Even if the urine should leak around the tube, it is immediately aspirated through the slot in the tube *A*. In this way the bladder, the space of Retzius, and the abdominal wall are kept absolutely dry until complete healing takes place. When cystitis is a complication, the aspirating tube is left 8 days longer in the bladder before being elevated.

This contrivance may be used for a continuous wash-out by allowing an antiseptic solution to drip



into the large tube, or for intermittent lavage when the fluid is introduced in to the tube *A*, through a catheter, in the early stages and through the urethra in the later stages. In both instances the fluid is immediately pumped away without the slightest spilling, thus avoiding any disarrangement of the bed.

A Sprengle pump attached to the water main is the aspirating mechanism, and certain rooms in the hospital are set aside for bladder cases.

The essential principle in the system seems to be that an enormous quantity of air is pumped through the bladder. The air inhibits aerobic and anaerobic bacterial growth and has a drying effect, so that the wound heals under the same conditions as does a clean laparotomy incision.

In our clinic this method faithfully carried out has marked as distinct an advance in the treatment of prostatic patients as did careful pre-operative treatment. It has also robbed these cases of their unpleasant circumstances for the surgeon and for the patient, but above all, for the hospital and nursing staff, because it requires very little attention and eliminates the unpleasant odor.

THE OPERATIVE TREATMENT OF UNUNITED FRACTURE AT THE HIP

By ROYAL WHITMAN, M.D., F.A.C.S., New York

In Surgery, Gynecology and Obstetrics for June, 1921, I described an operation for ununited fracture of the neck of the femur. It was designed primarily for a class of cases in which, because of absorption of the neck, bone pegging, at that time more in favor than at present, could be of little avail.

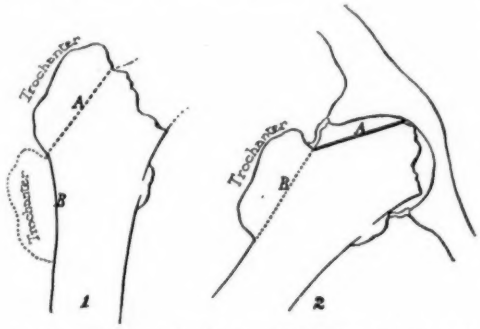


Fig. 1. The condition in ununited fracture of the neck of the femur in which the neck has entirely disappeared.

Fig. 2. The new bearing surface provided by removing the trochanter and transplanting it lower down on the shaft.

The operation, first performed in 1916, consisted in removal of the head of the femur. The trochanter was then cut through at its base with its attached muscles and turned upward. The new bearing surface or improvised neck thus obtained was placed in the acetabulum at an angle of abduction of about 25 degrees and the trochanter with its attached muscles was then drawn downward and implanted on the outer surface of the femur from which the cortex had been removed at a sufficient tension to support the femur in the new articulation. Thus the distance between the origin and insertion of the abductor muscles having been restored, the voluntary control of this most important range of motion was assured. For these reasons it was called the reconstruction operation.

In the description it was compared with two alternative procedures, which involved the removal of the head of the femur.

Fig. 3. An ununited fracture of the neck of the femur in which the neck has been completely absorbed.

Fig. 4. The effect of the operation in reconstructing a neck and restoring muscular leverage.

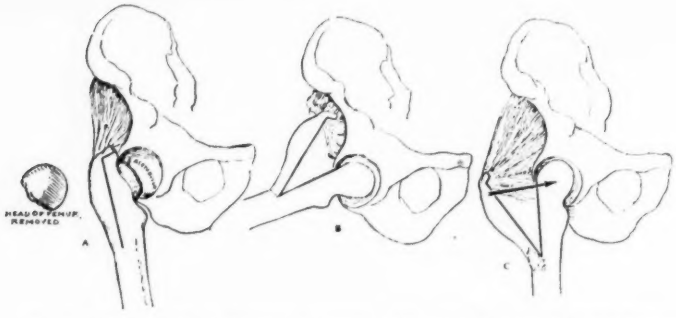
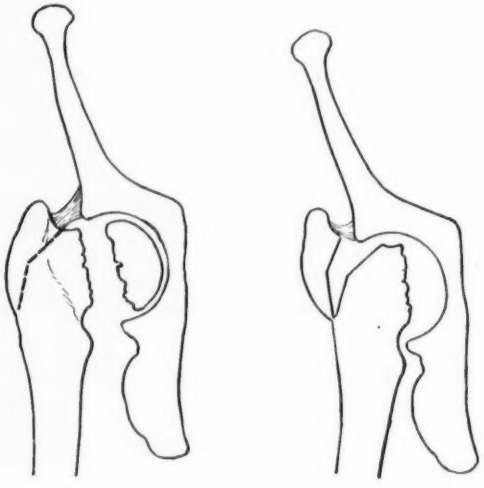


Fig. 7. Albee's method of treating ununited fractures of the neck of the femur by removing head of femur and producing greenstick fracture, the trochanter being swung outward on the periosteal hinge. The remains of the neck of the femur and upper end of the great trochanter are to articulate with the acetabulum, the inverted portion of the capsular ligament contributing to the formation of the new articulation.

The first of these was employed by Dr. Galloway of Winnipeg, who inserted the entire trochanteric extremity in the acetabulum. The second one of these procedures was that of Dr. Albee who separated the trochanter from the shaft with an osteotome sufficiently to permit the introduction of the upper extremity of the femur to the acetabulum.



Figs. 5 and 6.[1] Old ununited fracture of the neck of the femur with erosion of most of head and neck and with marked osteoporosis of the remaining shell of the head. The trochanter is separated with osteotome, as shown by dotted lines in Figure 5 and forced outward with the overlying soft structures below as a hinge. The removal of the head then allows the neck to be displaced into the acetabulum. Albee 1919.

[1] Figures 5 and 6, from Albee's *Orthopedic and Reconstruction Surgery*, 1919; Figures 7 and 8 from J. Am. M. Ass., 1925.

In a recent paper,[1] Dr. Albee states that his procedure was misrepresented by me, particularly in the criticism that the trochanter in its elevated position involved a complete loss of leverage, therefore lessened muscular control with a consequent tendency toward flexion and adduction; also that the copy of his diagram was incorrect. I therefore reproduce Dr. Albee's original figures from his book *Orthopedic and Reconstructive Surgery*, 1919. I think that the relation of the trochanter to the acetabular rim and to the origin of the abductor muscles will indicate loss of leverage, and the consequent limitation both of the voluntary and passive range of abduction that justifies my criticism.

It appears, however, that this original operation has been radically modified, as is evident from a comparison of the two diagrams 1919 and 1925, in order to construct what Dr. Albee calls a "physiological bone muscle lever." This introduces a new element to the discussion.

The purpose of the reconstruction operation is to provide a secure support in locomotion which will permit a useful degree of voluntary movement without danger of subsequent deformity. This, also, I assume, is the purpose of the Albee procedure and on this basis the two may be compared.

The reconstruction operation has from this standpoint three distinct advantages. The first is simplicity of design. The second is ease of execution, since it does not involve extensive stripping

[1] Albee, F. H. Reconstructive and plastic operations on the hip. J. Am. M. Ass., 1925, lxxxv, 1345.

of the tissues from the pelvis nor splitting the shaft of the femur, with consequent reduction of the weight-bearing area. This is a point more clearly shown in Dr. Albee's original sketch than in the somewhat idealistic Figure 7. The third advantage is the comparative certainty of the result, since the stability of a lever formed from a fragment widely separated from the shaft is necessarily dependent upon the uncertainties of repair and the adaptation of the tissues to the conditions.

I am interested in Dr. Albee's statement that bone pegging is advisable in not more than 10 per cent of ununited fractures at the hip. This is certainly an admission from such an enthusiastic exponent of this procedure, and it confirms my opinion that if non-union follows in a case in which it has been demonstrated that the fragments have been accurately apposed for a sufficient time, it indicates such an incapacity for repair, that further efforts to secure direct union are of very doubtful expediency. In such cases one has now the choice between the reconstruction and the physiological bone muscle lever operation which Dr. Albee calls "his reconstruction operation."

In order, therefore, to avoid confusion I suggest that the term reconstruction operation be limited to the procedure that I have described for the following reasons:

First, priority. The operation has been employed practically unchanged during the past 10 years, and is now supported by a large background of practical experience. It has consequently an established place in hospital records and in surgical literature.

Second, the title is descriptive, in the sense that the operation represents an attempt to restore the former mechanical relation of the components of the hip joint.

Fig. 8. Result after bone-muscle lever has united in place; illustrating the wide distance between the great trochanter and the side of the pelvis in proximity to the rim of the acetabulum, thus allowing for generous abduction. Albee 1925.

It seems to me that Dr. Albee's secondary title of bone muscle lever operation should be chosen to designate a procedure which, although it may be physiological, has no counterpart in human anatomy.

INSULIN GLUCOSE TREATMENT OF SHOCK[1]

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THE term shock was introduced in 1795 by James Latta to describe the condition following severe injury. Shock may be defined as a general exhaustion of the vital centers arising from an injury or profound emotion. There are many theories as to the cause and essential nature of shock, but none is entirely satisfactory. Henderson thinks it is due to a deficiency of carbon dioxide in the blood. Boise claims it is due to cardiac spasm following exhaustion. Meltzer regards it as an inhibition of bodily functions in general. Keen and Mitchell over 50 years ago regarded it as the result of vasomotor failure. The greatest modern advocate of this is Crile. The vasomotor theory maintains that there is exhaustion or inhibition of the vasomotor mechanism; the exhaustion is gradually induced; inhibition is suddenly induced.

Shock, for the purpose of this discussion, may be classified as traumatic, septic or toxic, anaphylactic, and that due to worry, fear, excessive muscular exertion, hæmorrhage, starvation and insomnia. Cannon (2) has accumulated evidence that the initiating factor in traumatic shock is a toxic agent developed in the damaged tissues, and that the sustaining factor is a low blood pressure. The low blood pressure in both clinical and experimental shock is explained by a diminution of the blood volume, an actual decrease in the amount of fluid which is kept circulating. McIver and Haggart (13) crossed the circulation of two cats, caused shock in one, and allowed its blood to flow through the vessels of the second cat. They feel that they have obtained evidence suggesting that some substance capable of producing shock is taken up by the circulation from a traumatized area. In 1910 Henderson (11) pointed out that in the absence of an adequate supply of oxygen, the development of acid substances in the tissues might be expected in consequence of the partial asphyxia. Later Crile (4) and his co-workers reported results which indicated that a condition of acidosis is present in various clinical states, including shock. In 1917, while studying the toxæmia of gas gangrene, Wright observed a reduction of the alkalinity of the blood stream as determined by titration with acid to a certain end point. Patients suffering with gas gangrene have many of the symptoms of shock, and Wright felt that the acidæmia, as he called it, was the cause of the symptoms. Porter (16) believes that fat embolism is the cause and has actually demonstrated these emboli in the blood stream. Crile (5), who has devoted a great deal of thought to this subject, has shown, working with animals, that constant stimuli sent to the brain centers will cause shock, and these brains examined histologically, show a hyperchromatolysis, then a hypochromatolysis of the cells, together with degeneration of the cells of the liver, thyroid, and adrenals; in other words, a state of exhaustion. He then showed that the brains of humans dying of infection and eclampsia show the same condition.

To sum up, shock may be considered as the result of an intense stimulation of the kinetic system by physical exertion, emotion, trauma, toxins, anaphylaxis, etc., which leads to physical changes in the kinetic system, and which, if carried far enough, exhausts that system. The kinetic system continues to be activated so long as there is life; but normal activation does not cause exhaustion. The difference between shock and normal processes is one of intensity and not of kind. The shock following a long general anæsthesia may be attributed to the internal asphyxia and acidosis, as well as to the trauma incident to the operation, the hæmorrhage, and the absorption of the crushed muscle tissue. The border line between a severe postoperative acidosis and pure shock is a difficult one to draw, and for clinical and therapeutic purposes, need not be separated. During health, the heat energy of the body is derived principally from the combustion of the carbohydrates, and to a lesser degree, from the fats and protein. Under these conditions, there is, of course, a great excess of antiketogenic material. When no carbohydrate is available, the heat energy then must come from the fat, and to a much less extent from the protein. The balance is now thrown in the other direction, and there is a great excess of ketogenic material which is not entirely compensated by the small amount of carbohydrates obtainable from the protein. There is, in consequence, a great production of ketones. The ketone acids then combine with the alkali of the blood stream and reduce the carbon dioxide combining power. This decrease in the alkali reserve is accompanied by a diminished alkalinity of the blood

[1] Read at the Congress of the Associated Anæsthetists of the United States and Canada, Atlantic City, New Jersey, May 27, 1925.

stream. These same conditions are present in involuntary fasts, in prolonged vomiting, in cyclic vomiting, after etherization, and at the onset of some of the acute infectious diseases.

The theoretical and laboratory aspects of this problem have recently been further studied by Levine, Gordon, and Derrick (12). They studied the changes in the chemical constituents of the blood following a marathon run, and showed that a correlation existed between the blood sugar level and the physical condition of the runner at the finish. Those who had a normal sugar content showed no signs or symptoms of shock. Four runners who were markedly prostrated, and, in fact, one who was unconscious, had a very low blood sugar, and presented the typical picture of an overdose of insulin. With all of this evidence before us, it readily becomes clear that to combat the symptoms of shock rationally, we should devise some method whereby the body can be furnished with a substance that will give rise to an immediate supply of energy, and maintain that supply so long as becomes necessary, at the same time furnishing fluids to keep up the circulating fluid volume.

The usual methods of treatment heretofore have been directed toward maintenance of the fluid volume, elevation of blood pressure, and retention of body heat. The fundamental cell pathology, the internal asphyxia and acidosis, and the initiating factors of the shock have to a great degree been disregarded. The fluids used have been normal saline, glucose, soda, etc., with or without adrenalin or pituitrin.

A word as to the value of pituitrin and adrenalin in shock. Adrenalin when introduced into the circulation in therapeutic doses, causes a rise of blood pressure and cardiac stimulation. While this action would indicate its use in surgical conditions associated with low blood pressure, experience has shown that even under these conditions its value is limited. Even when it is given intravenously, its action is very brief, the total rise in blood pressure lasting only a few minutes.

In traumatic shock, while a rise of blood pressure may be secured, it leads to no permanent benefit. Cannon (3) states that the rise in blood pressure results from increased resistance in the tips of the arterial tree, with accumulation of blood in the arteries. This accumulation may lead to a temporarily better flow through the heart muscles and cerebral vessels. The increased arterial pressure gives a wholly spurious impression of the state of the circulation. Damming the blood back in the arterial portion of the circulation obviously does not increase the volume flow through the capillaries where it is most needed. In the British and American armies, the use of vasoconstrictor drugs practically disappeared during the recent war.

In low blood pressure due to acute hæmorrhage or to hæmorrhage and shock, the use of adrenalin is even less advisable. Since the effect of adrenalin in low blood pressure is not of permanent benefit and may be harmful if excessive doses are used, measures to prolong its action as by continuous instillation in saline solution are not advisable.

Our conception of shock is that in this state an internal asphyxia and acidosis with oxidative processes held in check or abeyance result in a state of exhaustion. I personally believe that this state is primarily caused by a sudden derangement of the central nervous system. Whether these two conceptions are correct or not, any method promoting combustion and oxidation, and at the same time furnishing heat energy, should be effective in combating shock.

In a previous communication before this congress (7), I described the specific results obtained in pre-operative non-diabetic acidosis by the use of glucose solution given intravenously and insulin hypodermically, and confirmed the original work of Thalhimer (19) in postoperative non-diabetic acidosis, who used the same method. Following this, I believed that the insulin and glucose so combined should be just as effectual in shock as in non-diabetic acidoses, for the underlying pathology is very similar; since here it was possible to furnish an immediate supply of heat energy and fluids, and maintain that supply so long as becomes necessary. I soon had an opportunity to try this, and in two recent publications (8, 9) described the apparently specific response of shock as seen clinically, to glucose solution administered intravenously and insulin hypodermically. Since that time we have treated 31 cases successfully in our clinic, and have received confirmatory reports from several American clinics and one Canadian clinic. The following are typical case reports of the action of insulin and glucose in our hands in the treatment of shock.

Case 1. Mr. H. A., aged 25, had an arthrodesis of the shoulder-joint for tuberculosis. The operation lasted 2½ hours. During the course of the operation, the pulse climbed from 96 to 150, respirations from 18 to 38, and the systolic pressure fell to 75. Just as the cast was being applied, the patient became pulseless, the rate could not be ascertained, respirations increased to 40, and were very weak and shallow. The application of the cast was immediately discontinued, the patient put to bed and given

1,000 cubic centimeters of a 10 per cent solution of glucose intravenously, and 50 units of insulin subcutaneously in divided doses. The reaction in this case was miraculous. The pulse quality began to improve almost immediately, and 2 hours after the administration, the rate was 116, volume good, respirations 22, and the blood pressure 112–74; application of the cast was resumed, and convalescence was uneventful. Urine examination made immediately after the insulin-glucose injection was started, showed acetone three plus and a trace of diacetic acid. This was absent in a specimen examined 8 hours later.

CASE 2. Mrs. A. W., aged 64, was operated upon for gall-bladder disease. A large stone was removed, and the wall of the gall bladder was seen to be gangrenous. Because of the poor condition of the patient, the gall bladder was drained and the abdomen hurriedly closed. At the termination of the operation, the temperature was 98, pulse rate 96, respirations 20. The pulse and temperature began to climb, and 24 hours later the temperature was 104.8 degrees F., pulse rate 140, respirations 36, the quality of the pulse very poor, respirations shallow, and the patient was irrational and delirious. I felt that in this case I was dealing with a case of toxic or septic shock, complicated with a severe postoperative acidosis, as proved by the urine examination. One thousand cubic centimeters of a 15 per cent glucose solution were given and 60 units of U 20 insulin. The instillation occupied 2½ hours. Six hours later the pulse rate was 108, temperature 102.4 degrees F., respirations 22, mentality clear, and the urine examination showed absence of acetone or diacetic acid. In this particular case, the dilution of the circulating toxins amounted to 20 per cent, which I believe was one of the factors in the recovery. The removal of the internal asphyxia and acidosis enabled the body cells to regain their normal equilibrium and combat the shock.

CASE 3. Mr. J. M. was sent in with signs and symptoms of a perforated peptic ulcer of 5 hours' duration. One hour before admission, his stomach was washed with 2 quarts of tap water by his family physician, and because no return was obtained, he was sent to the hospital. On admission, the pulse was weak, thready, rate 168, respirations very shallow, rate 36, temperature 96.8, and systolic blood pressure 75. At operation, a perforation on the posterior surface of the pyloric end of the stomach the size of a silver quarter was cauterized, sutured by the purse-string method, and proper drainage instituted. During the course of the operation, 1000 cubic centimeters of a 10 per cent solution of glucose were given, and 50 units of U 20 insulin, and the patient was kept warm on the operating table until the termination of the infusion. Five hours later, the pulse rate was 110, of excellent quality, respirations 24, temperature 99.8, blood pressure 110–80. Convalescence was uneventful.

CASE 4. Mr. D. L., aged 52, was admitted for acute abdominal pain, incessant vomiting, and high temperature. On a previous admission, he was operated upon for empyema of the gall bladder with perforation, the gall bladder being drained only on account of his poor condition. He refused a secondary operation for removal of the gall bladder, and was discharged. At this time the diagnosis was perforation with peritonitis. A gangrenous perforated gall bladder was removed and a frank peritonitis was present. When he was returned to bed the pulse rate was 178, respiration 44, and temperature 100. One thousand cubic centimeters of a 15 per cent glucose solution were given and 75 units of U 20 insulin over a period of 3 hours. The quality of the pulse began to improve almost immediately, and 4 hours after the administration, the pulse rate was 114, of good volume, respirations 24, and temperature 102.2 degrees F. The next day the patient relapsed into a condition we felt to be toxic shock, and the same amount of insulin and glucose was given as on the previous day, and just as favorable response was obtained. The temperature was lowered over 2 degrees in the afternoon, at a time when we would normally expect a rise. Following this, the patient went through the usual course of a peritonitis and made a good recovery.

CASE 5. Mr. A. L., aged 34, was admitted for acute fracture of the twelfth dorsal spine. All the usual neurological symptoms of a transverse lesion of the cord at this level was present. A laminectomy was performed, and during the operation it was necessary to resuscitate the patient twice. He was returned to bed in intense shock. It was impossible to count the pulse, the respirations were weak and shallow, rate 48. Two thousand cubic centimeters of a 10 per cent glucose solution were given over a period of 3 hours, and 60 units of U 20 insulin in divided doses. Four hours later the pulse rate was 116, respiration 28, and no further trouble was experienced. Five days later he was again operated upon because he had not been relieved. A completely crushed cord was exposed and he showed symptoms of intense shock. He was given 1,000 cubic centimeters of glucose and 40 units of U 20 insulin, and 5 hours later he was out of danger.

In shock, as in nearly all abnormal conditions, we have a state of perverted body metabolism. In addition to this, the entire body is in a state of exhaustion, and to overcome this exhaustion, a source of energy is needed which will readily revive the dying cells. Glucose administered alone cannot always do this satisfactorily or quickly enough. We know definitely, as a result of the splendid experiments carried out by Ringer (18), that insulin oxidizes glucose; hence the introduction of the insulin causes a rapid oxidation of the glucose and supplies the energy needed.

Since time is always an important factor in the treatment of shock, the tremendous advantage of the insulin and glucose over glucose alone can readily be seen. The value of this treatment has been confirmed by Ginsberg (10) writing in the *Journal of the American Medical Association*. He treated a boy aged 11, suffering with a left Pott's fracture and contusions of the chest and abdomen. The day after the injury, the patient vomited incessantly and went into shock. The pulse ranged from 130 to 140, respiration 50 to 55, and the temperature was 100 degrees F. At 3 p. m. he was given insulin and glucose, and the next morning he had fully recovered. The urine which previously had shown four plus acetone and diacetic acid was now entirely negative. Here, a condition which was progressing rapidly toward extremis was immediately transformed into one of normal convalescence through the use of insulin and glucose.

METHOD

A sterile solution of glucose is used, preferably of 10 to 15 per cent strength. Five hundred to

two thousand cubic centimeters may be given, depending upon the severity of the condition. The usual cautions for any intravenous medication are taken. The solution is allowed to flow slowly into the veins so that the entire time of administration should be at least 1 hour, and preferably 2 to 4 hours. This precaution is extremely important when any large amount of fluid is introduced into the veins, for dilatation of the right heart is a real danger, and many serious results have ensued because of the too rapid rate of intravenous administration. The amount of insulin used depends upon the amount of glucose injected. For every 3 grams of glucose, 1 unit of U 20 insulin may be used. The total amount of insulin to be given should be divided into 2 equal doses, and 1 part given about 15 minutes after the administration of the glucose has started, and the remainder given at the end of the administration. As long as glucose appears in the urine, there is no danger of an insulin reaction, for this acts as a safety guide, and shows that there is more glucose in the blood stream than can be taken care of by the introduced insulin. It is well for the nurse always to have ready a hypodermic syringe of adrenalin when this treatment is given; for then any reaction can be easily and quickly counteracted. Besides the adrenalin, the juice of an orange or ordinary cane sugar can be used. We have never had an insulin reaction when we have used the above formula. It is well to give fluids by rectum at the same time in order to overcome the tendency of glucose to deplete the body of its fluids, since glucose acts as a diuretic.

Aside from using it in the treatment of non-diabetic acidosis and surgical shock I have used insulin and glucose to check the incessant vomiting of acute peritonitis. I also use it in the preoperative preparation of all surgical cases as a prophylaxis when the subject is not considered a good risk, and in all postoperative gastric cases, particularly in cases of gastric ulcer and resection. The patient is fed for days at a time through his veins. In Ochsner's (14) clinic, insulin and glucose is now being used in all cases of pernicious anæmia when blood transfusions have had no effect.

It is important to remember in connection with this, that certain drugs used simultaneously with insulin may diminish or nullify its effect, thereby accounting for some of the uncertain results obtained with it. Burn has shown that if pituitrin is given at the same time, the fall of blood sugar is diminished and sometimes abolished. The effect of a small dose of insulin is decidedly increased when ergotoxin is injected previously.

The question logically arises, and rightly so: What is the rationale behind this treatment?

In shock we have an initiating factor and a sustaining factor. The initiating factor may be sepsis, trauma, anaphylaxis; the sustaining factor is a low blood pressure, maintained by an actual decrease in the circulating fluid volume. In the first place, the introduction of the glucose into the blood stream raises the circulating fluid volume, thereby helping to remove the sustaining factor. The introduction of the insulin causes the rapid oxidation of the glucose; in the process of this oxidation, heat energy is given off to the cells which aids them in this time of need to regain their equilibrium and discharge their normal metabolic functions. The body cells when in a normal state possess remarkable power to adjust themselves to changing conditions, and in conjunction with the buffer salts of the blood stream, can usually emerge from a state of internal asphyxia and acidosis. I cannot help but believe that the heat energy supplied to the cells by the rapid oxidation of the glucose at a time when normal oxidative processes are checked or held in abeyance, is a tremendous vital factor in initiating the process of recovery of the cells.

Aub (1) studied the decrease of the metabolic rate in shock, which in 8 cases showed an average decrease of 33 per cent. He learned that the fall in metabolism was related in a way to the critical level of arterial blood pressure as indicated by the appearance of an acidosis. The introduction of the glucose and its subsequent rapid oxidation through the means of the insulin not only serves to raise the pressure, but also to increase the metabolic rate. In addition, we know from the work of Edwards and Page (6) of Cornell that the intravenous injections of glucose have a remarkable improving effect upon hypodynamic hearts, a condition usually found in shock. O'Neill, Manwaring, and Bing Moy (15) have shown that in anaphylactic shock in dogs, practically all the glycogen disappears from the liver in 15 minutes. They proved this both microscopically and by chemical analysis, thereby confirming the earlier work of Zunz and La Barre (20). We know from the work of Richter, that insulin with glucose causes the deposition of glycogen in the liver. Richter gave daily infusions of insulin and glucose to a patient with acute yellow atrophy. The comatose condition of the patient was immediately relieved. After death, the liver was examined and found to contain glycogen, a fact contrary to that obtaining in cases of acute yellow atrophy not so treated. We know from the work of Thalhimer

that insulin with glucose has a specific effect upon the pernicious vomiting of pregnancy and in eclampsia.

From the work of Zunz, La Barre, and the Leland Stanford investigators, it seems that the first defensive reaction of the organism in shock is the mobilization of all the available glycogen in the blood stream to be distributed to the body cells to furnish them energy. This supply is soon exhausted, however, as these men have shown; hence the replenishing of the glycogen, as by insulin and glucose therapy, is to me of extreme importance in the rational treatment of shock.

I do not wish to leave the impression that insulin and glucose are a panacea for all evils, nor will their administration supplant blood transfusion in shock caused by great loss of blood; but in the fields discussed its action has been far more efficacious and rapid than by any method heretofore utilized. Irrespective of our theorizing, however, clinically it appears to be efficacious, and in the final analysis, that must be our chief criterion.

DISCUSSION

DR. ALBERT J. OCHSNER: Dr. Fisher's work and his results are promising and interesting. I have not had the experience with insulin and glucose that he has had, but in a few cases I have had the same results as he. Dr. Fisher mentions a case of pernicious anæmia apparently benefited by insulin and glucose. We had a very interesting experience in such a case.

When the patient was admitted to the hospital, the red blood cells were 984,000; white blood cells 5,400; with hæmoglobin, 40 per cent; she belonged to blood group IV.

On March 16, 1925, the day after admission, 650 cubic centimeters of blood was transfused by the Percy method. Donor and recipient were both of Group IV. On March 23, 1925, another transfusion was made without the patient being regrouped, Group IV donor being used. Severe reaction followed the transfusion with a lowering of the blood count. On March 30 the patient's blood was regrouped with the result that definite agglutination took place with standard sera both II and III. The patient's serum was matched with the red blood corpuscles of four different Group IV donors, and in every case marked agglutination resulted. From March 30 to April 6, the patient's condition became progressively worse, she could retain nothing, had diarrhœa and was semi-conscious. The serum again matched with the blood of individuals belonging to the following groups: Group I, one person; Group II, 6 persons; Group III, 1 person; Group IV, 9 persons. There resulted a definite and positive agglutination in all 17 of these cases.

Because of the critical condition and acetone odor to the breath, she was given 300 cubic centimeters of a 10 per cent glucose solution by the drop method intravenously, so that about 1 hour was taken for its administration. Fifteen units of insulin was given hypodermically. On April 7, the general condition was very much improved, with no more vomiting. On April 8 and 10 she was again given 300 cubic centimeters of 10 per cent glucose solution with insulin. The general condition changed completely. The appetite became voracious, the skin lost its waxy appearance, and the lips began to have some color. The blood picture also changed completely, the red blood cells increasing up to above three million with a hæmoglobin of 60 per cent.

On May 1 she complained of a glossitis. The differential blood count showed a relative lymphocytosis. She was again given glucose intravenously, together with insulin, which caused a prompt disappearance of all glossitic symptoms and brought about a normal blood picture. She was again grouped and found to belong to Group III. Her serum was matched with the blood of 11 persons belonging to Group II with a positive agglutination in each case. It was matched with the blood of 6 persons belonging to Group IV with no agglutination.

The case emphasizes the advisability of matching the blood in cases of pernicious anæmia before doing a transfusion. Group IV cannot be considered as a universal donor in certain cases of pernicious anæmia. The patient received the first transfusion with very beneficial results, which showed that at that time the bloods of donor and recipient were compatible. While under observation, however, the entire character of the patient's blood changed. The blood became rabid, as evidenced by an agglutination when her serum was matched with the blood corpuscles of all other groups including Group IV which is characterized by the inability of its red blood cells to be agglutinated by any serum.

During the patient's decline, her condition became so alarming that death seemed imminent. Because of the rabic character of her blood it was impossible to resort to blood transfusions, and the case appeared hopeless. Glucose with insulin was administered with a very remarkable result. Whether the beneficial effects were due to the combating of the acidosis which was undoubtedly present or to a possible effect upon the disease process itself, cannot be decided, because later when the glucose and insulin were given, the glossitis and the relative lymphocytosis disappeared even though no acidosis was present. One may possibly assume that the glucose and insulin exerted some effect upon the general metabolism of the body to bring about an alleviation of the symptoms. However, one must be extremely careful and cautious in attributing any betterment to any one therapeutic agent in cases of pernicious anæmia as one finds in the literature numerous reports of cases apparently in a hopeless condition which have gone into a spontaneous remission without any form of therapy.

I examined the patient personally May 17, 1925. She has maintained her excellent condition. Whether this will be continued it is impossible to say.

Insulin-glucose therapy seems rational in the treatment of shock, and should prove very valuable in addition to the measures already in vogue. I have seen some of Dr. Fisher's work in his clinic at Milwaukee, and the results they secure with insulin-glucose are very impressive.

DR. GEORGE W. CRILE: It has often been maintained that the central nervous system can be separated from the field of operation in shock. I do not believe this can be done. In shock, there is always present an interference with the internal respiration. I believe that the anæsthesia caused by the administration of general anæsthetics is due primarily to this interference. I should like to make three points in regard to the prevention of surgical shock: first, there should be as little general anæsthesia as possible; second, the internal acidosis should be relieved; third, the operation should be carried out with as little loss of blood as possible and as rapidly as is consistent with safety.

Our object heretofore has been to maintain blood pressure merely to improve the internal respiration. Now comes Dr. Fisher's work attacking this very point in the treatment of shock. In a limited number of cases we have secured results paralleling those reported by him.

DR. FISHER, closing the discussion: In treating shock, it is just as illogical to focus the attention upon the blood pressure, or the temperature, or the fast thready pulse, as it would be to treat the headache only in a case of brain tumor. These are just manifestations of an underlying abnormal process. This process, I believe, is mainly an interference with the internal respiration causing internal acidosis and asphyxia resulting in lessened oxidations within the cell. By promoting and improving such oxidative processes, we will promote the recovery of the body cells, and hasten recovery from shock. I feel, as Dr. Crile does, that the problem of internal respiration is not the entire picture in shock, but a successful handling of this phase will, to a great degree, prevent many of the dangers accompanying shock. My method is simple, requires no elaborate apparatus nor mysterious technique, and can easily be given at the bedside.

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EDITORIALS

SURGERY, GYNECOLOGY AND OBSTETRICS

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MEDICAL EDUCATION IN GREECE

AFTER a year spent in Greece in close contact with the best and most influential elements of Greek society, as well as the rank and file, it is plain to me that most Americans have erroneous ideas regarding modern Greece. Education is universal in Greece, and their system of compulsory primary education is the oldest in the world, while their system of secondary schools for both men and women will compare favorably with that of other countries. Their language has hindered a better understanding of other nations as it has also prevented a more exact knowledge of them. This condition will be improved in the near future as the adoption of the study of English becomes more widespread. Time and attention formerly bestowed upon German is now rapidly being given to English; in fact at present as a result no doubt of the great aid from Americans during the war and following the Smyrna disaster, English is received more favorably than French. In Greece, at present, radical reconstruction work is going on along every line, and it would be well for American professional and business men to take a more active interest in them as the Greeks are now more susceptible to American influence than to any other. They are fully aware that practically all other influences are heavily tinctured with selfishness.

The University of Athens is a real University and the medical school is built on modern principles of medical education, although largely from French and German models.

In studying modern Greece, one must keep constantly in mind the fact that Greeks are hampered and retarded by an amount of tradition which exists in few other countries. Their great pride in their traditions is in many ways a handicap. The University is under the control of the state and includes the departments of theology, the arts and sciences, medicine, engineering, dentistry, and a number of other branches of learning. There have been medical schools in Greece since ancient times, but the present school as a department of the University is of comparatively recent development.

A well arranged catalogue gives the various courses of the school in sufficient detail. Women are admitted on the same terms as men, and a considerable number are in attendance. The medical course covers five years of two terms each. This gives the student the equivalent of a master degree and will admit him to practice. In order to receive the degree of doctor of medicine he must have one year of post-graduate (interneship) work and present a thesis. Foreign physicians are admitted to practice on the presentation of acceptable credentials and an oral examination in seven fundamental subjects.

I spent considerable time in visiting the medical school, and in attending its clinics and lectures. There are at least thirteen main buildings which house the principal part of the medical school and its clinical facilities, and there are a number of smaller and less important ones. It should be borne in mind that at the time of my visits to the various lectures, clinics, and laboratories of the school, they were seen at a great disadvantage. During the years of the war the school has been closed. Some of its best teachers had been dismissed on account of their political sympathies, and the school was in the process of re-organization. In fact, the political control of the university is one of its misfortunes.

The University building is situated in the center of Athens on a broad avenue called University Street, and only a block away is the main laboratory building occupying a whole block and providing for the departments of physiology, anatomy, pathological anatomy, pharmacology, neurology, special pathology, etc. In the dissecting rooms of the anatomical laboratory the first and second year students were earnestly and industriously at work at practical dissection under the direction of the head of the department and several assistants. Bacteriology and general pathology are taken care of in still another building; and just outside the city on the Sacred Way are laboratories where vaccines and serums are manufactured. This is called the Pasteur Institute and its laboratories are used for teaching purposes. As far as buildings and equipment are concerned, the laboratory department of the University would compare favorably with some A-grade schools of America.

Near the University is Hope Hospital, or the city hospital. This hospital was erected and is supported by the city, but the patients are under the care of the staff of the medical school and are used for teaching purposes. Very good clinical facilities are provided in this hospital. General medical and surgical clinics are held here. I had the privilege of attending some of these clinics and found them practical in character. Students are taken to the bedside and taught to examine the patients and make a diagnosis. There are also lecture rooms, with blackboards and charts, stereopticon, and other facilities for teaching, where lectures, both didactic and clinical, are given to the whole class and demonstrations held, but bedside ward teaching is a usual method. The Evangelismos, an unusually beautiful and well equipped general hospital is used for teaching purposes.

The Aeretion Hospital provides for the clinical teaching of general surgery and gynecology. A number of clinics at this hospital were visited. The general operating clinics are held in two amphitheaters, and there are bedside clinics in the wards. The students are required to examine patients and to make dressings and to do minor operations. In adjoining grounds is the Aiginition Hospital, which is devoted to neurology and mental diseases. These two hospitals are comparatively new and beautifully located with considerable ground surrounding them.

There is a special building for the treatment of diseases of children. A much larger, more complete, and better appointed children's hospital, consisting of four or five buildings, one of which contained an operating theater, was in the course of construction at the outbreak of the war, and has since been completed. Much of the material for this hospital was brought from America. Near the University is a well appointed maternity hospital.

Ophthalmology, otology, and laryngology have a good building, well appointed and devoted to their special needs. These special hospital buildings are commodious, and the method of instruction seems practical and

efficient. The polyclinic located in the old section of the city has been entirely rebuilt on the American plan since the war and is accessible to the poorer population. Here there are several departments of medicine and surgery, which furnish facilities for practical instruction. It is mainly for out-patients but it has a considerable number of beds. The dental school is in this building.

The Greek Red Cross has received a large fund from wealthy friends with which they have built a large new hospital on the American plan and with a training school for nurses conducted on the lines of our American training schools. This hospital has become a part of the University group.

Anyone studying the clinical teaching facilities of the medical school will be especially interested in the Syngros Hospital for venereal and skin diseases. This hospital was built, equipped, and endowed by a wealthy Greek, Andrew Syngros, and is in every way a model institution of its kind. In fact, it would be difficult to find a more perfect institution for the treatment and the teaching of these diseases. The active interest and enthusiasm of the directing physician, Dr. Photinos, keeps it abreast of the times, and he has developed the latest methods of giving instruction. An interesting feature of the management is that the female patients are practically prisoners in this hospital behind locked doors. The clinic here occupies an afternoon. One of the clinics attended was given over to a discussion of chancre. First, the students studied the pathology in the laboratory. Here a number of microscopes with sections of tissue were in readiness for the microscopical examination. A description and pictures of the tissue were also provided. Features of the disease as relating to the specimen were discussed. In this way a variety of sections and a variety of descriptions were taken up and each student had the opportunity of making the examinations under direction of an assistant.

On the other side of the same room was a line of male patients, each exhibiting his lesion, which had been previously cleansed, and an opportunity was given each student to examine these. In another room were ten or more female patients on high examining-tables (the faces were covered) so that the students could easily and quickly examine the lesions.

A fair criticism of the medical school would be that on account of their traditions, their long existence under Turkish rule, and their far removal from the influence of Western civilization, their teaching is too largely theoretical and argumentative. While far-seeing individuals of influence and ability, like Andrew Syngros, for example, have provided the medical school with laboratories and hospitals for a most complete and practical medical school, the average professor could improve his course by the introduction of more practical methods. The large group of buildings devoted to the interests of medical education attest the fact that a very practical and strong effort has been made and is still in progress in Greece to make the medical school a practical working school for the education of doctors thoroughly qualified to care for the sick. While the department has defects and deficiencies, certainly its well organized faculty, well developed program, and its group of buildings and hospitals devoted to medical education would be a credit to any city or country. After visiting a large number of their clinics and laboratory demonstrations and watching their practical work, the American observer is easily convinced that the great need is an infusion of British and American methods and ideals. Much of the new hospital equipment since the war has come from America.

A new University with a complete medical school is projected at Salonika. Certain American interests are back of this movement and much is expected of it.

One of the great calamities of the Smyrna affair was the destruction of the new medical school in that city. A wealthy Greek had spent about six million dollars on this project. A large amount of equipment was in the harbor on board ship at the time and was dumped into the sea by the Turks. It is understood that the institution is a complete loss.

In conclusion, I would suggest that surgeons visiting the Near East interest themselves in medical education in Greece. They need the aid and sympathy of the profession in Great Britain and America and will greatly appreciate our interest. CARL E. BLACK.

LOCAL ANÆSTHESIA

THE idea of performing painless operations on a conscious patient is probably as old as any other modern development. Yet the recent widespread use of local anæsthesia is based on the discovery of the anæsthetic properties of cocaine well known to Indian healers, its isolation from cocoa leaves and its first use in eye surgery by Koller in 1884. This date marks the beginning of rapid development, mainly in two directions. First the technique of local anæsthesia was evolved, step by step. Careful anatomical studies revealed exact landmarks for approaching nerve trunks. Methods of infiltration, peripheral and central nerve blocks, were described. Although some modifications may still be developed, practically all regions of the body have been thus explored. The development of the pharmacological side of the question has not been so rapid and is by no means complete. Yet important steps may be noted here. Cocaine, except for surface anæsthesia, has been replaced by the much less toxic novocain. Small amounts of adrenalin have been added to slow down the rapid absorption of novocain and thereby prolong the duration of anæsthesia. Substitutes of novocain appear daily.

The object of further development would be to find a still less toxic and more active anæsthetic, that would alleviate postoperative pain for at least the first hours after operation, without causing any tissue irritation. Suggestive experiments have been made along this line.

Twenty years have elapsed since the appearance of the pioneer work of Heinrich Braun on local anæsthesia. It is instructive to watch the extent of these methods in various surgical institutions. At the University of Heidelberg the percentage of major operations performed under local anæsthesia rose from 11.4 per cent in 1906 to 54.2 per cent in 1911. H. Braun's clinic in Zwickau shows a rise from 24.8 per cent in 1908 to 50.5 per cent in 1913. The highest percentage of local anæsthesias was published in 1914 from the First Surgical Clinic of Budapest with 95.11 per cent. Ten years later in 1924 the curve of this same institution dropped to 64 per cent.

If the patient's age, psychic state, in addition to the absence of localized or generalized infection permit us to use a safe and technically simple method of infiltration or nerve block, then local anæsthesia becomes the method of choice in operations on the head, neck, chest, upper extremity, and lower pelvic organs. Brain operations are done with remarkable ease under local anæsthesia, but unconscious and restless patients should be excluded. Blocking the trigeminal branches is a safe and sure procedure. In doing thyroidectomies or removing cervical lymph nodes perfect anæsthetization can be secured

without the necessity of deep paravertebral injections. The segmentary innervation of the thorax renders chest operations a favorable field for intercostal anæsthesia. Paravertebral injections are not without danger because of the proximity of pleura and spinal canal. They can be perfectly substituted by intercostal block or if a block of rami communicantes is necessary, by splanchnic anæsthesia. The upper extremity is safely blocked at the brachial plexus and also further peripherally around the wrist or at the base of the fingers. Sacral, transsacral or parasacral blocks will take care of floor of pelvis, bladder, prostate, perineum, and rectum.

As to abdominal operations, in my limited experience the following procedure has proved to be most successful. If the operation is short, whether the patient is young or an adult, general anæsthesia is the method of choice, especially if general abdominal exploration is planned. This can be combined to great advantage with an abdominal wall block, which if well done not only anæsthetizes the incision but relaxes the abdominal wall. About five-sixths to nine-tenths of the general anæsthetic is saved this way. A light gas or ethylene anæsthesia is sufficient for the intra-abdominal manipulations and the relaxation is obtained by local anæsthesia. In well localized circumscribed lesions if the patient is above fifty or otherwise handicapped and the operation is going to be a long one, splanchnic anæsthesia gives better end-results. The infiltration of the prevertebral tissue in the height of first lumbar vertebra performed through open abdomen (Braun) has several advantages over posterior route. Gastrectomy for penetrating ulcer or carcinoma, common duct stone in a deeply jaundiced patient are the most frequent indications.

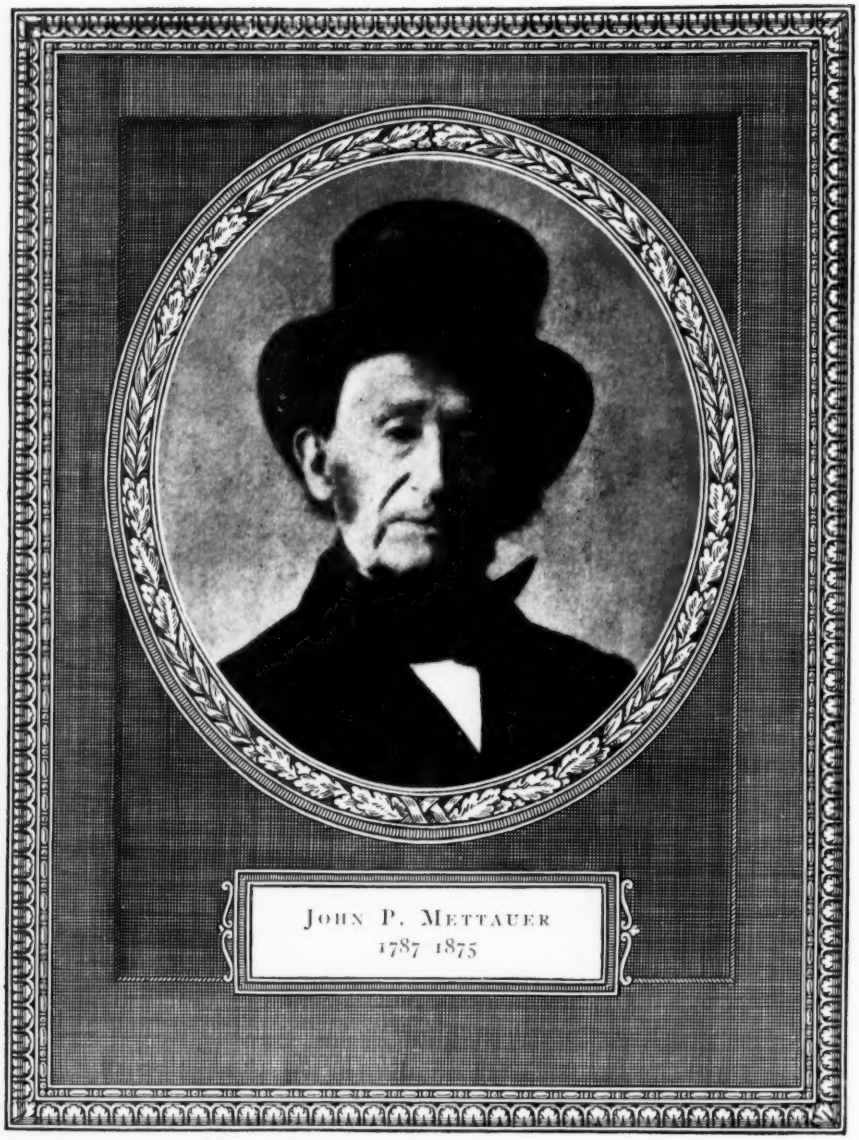
Another questionable point is the anæsthesia of the lower extremity. Spinal anæsthesia, if done at all, should be limited to this region and not attempted above the umbilicus. In patients above forty, especially if marked organic lesions are present, spinal anæsthesia still maintains its place and ought not to be entirely discarded. The absence of shock in handling nerve trunks as in amputation of the femur or in sciatic suture is very remarkable when spinal anæsthesia is used. Otherwise local field blocks or light general anæsthesia in cases in which deep relaxation is not necessary are equally satisfactory.

The diminution of postoperative pulmonary complications, the absence of heart, liver, and kidney damage, the diminution of gastrointestinal and bladder paralysis and the possible co-operation of the patient can be mentioned as advantages of local anæsthesia.

The relationship between local and general anæsthesia is not that of rivalry. Both local and general have their advantages in certain types of patients and certain regions of the body. They can also be combined to a great advantage, especially in abdominal surgery. However, there is one great difference between the administration of the two methods. The general anæsthetist, whether a specialist or a well trained nurse, is entirely separated from the operation itself. The less he is interested in the procedure, the more attention he will give to the narcosis. Local anæsthesia should be given by the surgeon himself or his first assistant. It is a part of his technique, it should be part of his surgical training. It should be taught in the medical school, in anatomy, in dispensary clinics and chiefly during postgraduate work. There is no need then to make a specialty out of local anæsthesia. The surgical specialists can quickly adopt simple methods peculiar to his particular field. The growing importance of these methods should be recognized but not overestimated.

G. DE TAKATS.

UNIV. OF MICH.



JOHN P. METTAUER
1787 1875

MASTER SURGEONS OF AMERICA

JOHN PETER METTAUER

ACCOMPANYING Lafayette's American expedition was a young French surgeon: Francis Joseph Mettauer. After the battle of Yorktown, the young surgeon, at the solicitation of General Lawsón, the Randolphs, and the Henrys, was persuaded to remain in the new country and settled in Prince Edward County, Virginia, where, soon afterward, he married Elizabeth Gaulding. In 1787, a son, John Peter Mettauer, was born to the couple. Apparently, the youth early decided to follow his father's profession; in 1806, at the age of nineteen, he received the A.B. degree from the neighboring college of Hampden-Sidney; in 1809, he graduated from the medical department of the University of Pennsylvania. At Pennsylvania, young Mettauer was particularly fortunate in coming under the influence of such men as Shippen, Wistar, Physick, and Rush: that he profited by his opportunities and his early manifested ability is evidenced by the expressed opinion of his preceptors.

On receiving his medical degree, Mettauer returned to his native state, settling in Prince Edward County near Farmville, Virginia, with the resolution: "Though doomed to labor in the country as a practitioner . . . to continue my studious habits." His skill seems to have won immediate recognition; he found himself engaged in a busy practice without the necessity of passing through the probationary period which is the lot of the modern medical graduate. With the passage of years, his work became more restricted to surgery, though he always resented the insinuation that he was a "specialist." His surgical skill was so remarkable and the success that followed his efforts was so striking that patients came to him from far and wide; from the most remote regions of America and even from abroad. At the height of his career, it was no unusual thing for him to have as many as sixty patients under his care at one time, and every suitable house in his neighborhood is said to have sheltered at least one patient convalescing from an operation or one awaiting his turn at the master's hands. It is a matter of record that Mettauer operated 800 times for cataract; the number of such operations probably was in excess of this; he operated for stricture over 200 times; and Dudley's record of "cutting for stone" 225 times is eclipsed by Mettauer's 400 similar operations.

Mettauer's operations were characterized not only by skill but by daring and originality. He was undoubtedly the first western surgeon to operate for cleft

palate, using, for this purpose, an instrument devised by himself. He was certainly among the first to undertake such operations as amputation of the shoulder, ligation of the carotid, and resection of the superior maxilla. Though such ability to occupy the forefront of his profession through his early employment of the suggestions of his contemporaries stamps Mettauer as an unusual man, probably his greatest claim to fame rests upon his being the first surgeon successfully to operate for vesicovaginal fistula. Though Sims is generally credited with the honor of introducing the operation for the alleviation of this distressing condition Mettauer described the procedure in the *Boston Medical and Surgical Journal*, vol. xxii, page 154, twelve years before Sims first conceived the idea; and five years before Sims first discussed the operation for vesicovaginal fistula, Mettauer wrote in the *American Journal of the Medical Sciences*, new series, vol. xiv, p. 117: "I am decidedly of the opinion that every case of vesicovaginal fistula can be cured, and my success justifies this statement."

In spite of the enormous volume of his operative work, Mettauer found time for other things. He was a prolific writer; literally hundreds of articles, not only on surgical topics but on such subjects as yellow fever, puerperal fever, and Asiatic cholera, are to be found under his name in the leading medical journals of his day. There is still in existence the manuscript of his treatise on surgery; never published, for some unknown reason. This treatise comprises some three thousand pages of closely written legal cap; and can well stand as a model, both for accuracy of analysis and excellence of phrasing. In 1837, he opened a medical "institute"; being impelled to this step by the paucity of medical schools in the United States at that time. His institute continued in successful operation, at first independently, later, as a part of Randolph-Macon College, until 1848.

Mettauer lived to the advanced age of eighty-eight years. Apparently, the infirmities of age had little affected him; in the last week of his life, his eye was sufficiently keen, his hand retained the requisite steadiness, and his judgment was reliable enough for the successful performance of an operation for cataract; a second for stone; and a third for amputation of the breast. Just after these, as a result of exposure incident to attending a patient suffering from opium poisoning, he contracted pneumonia, and this "friend of the aged" caused death in two days.

The clinic of this remarkable man of the 19th Century seems to have as its only parallel in this, the 20th Century (certainly in the western world), the Mayo Clinic of Rochester, Minnesota. The life and achievements of this pre-Listerian surgeon stamp him as among the leaders of his profession. Few surgeons surpassed him in daring and originality; he was among the foremost educators of his day; and his contributions to medical literature alone should have saved his name from oblivion. In spite of this, Mettauer is unmentioned by many medical biographers; while those who refer to his work do so in a very casual manner. *Sic transit gloria mundi.*

A. MURAT WILLIS.

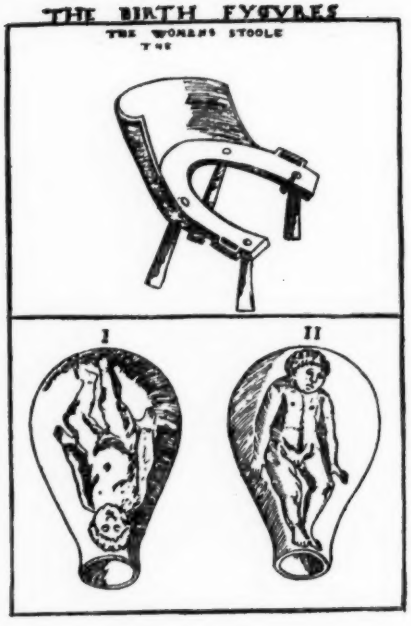
UNIV. OF MICH.

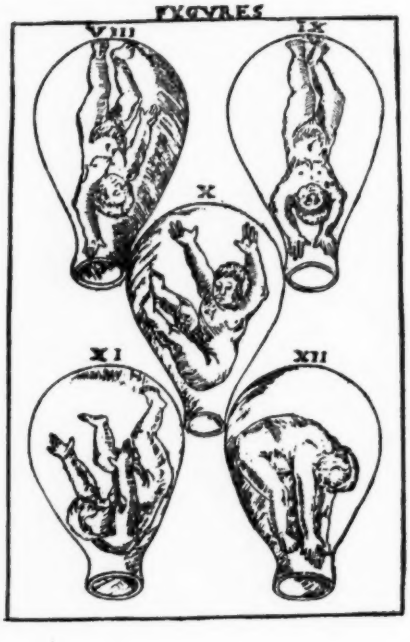
The byrth of

mankynde, otherwyle named the womans booke. Newly set forth, corrected and augmented. Whose cõtentes ye maye rede in the table of the booke, and most playnly in the prologue.

By Thomas Raynold phisition.

Anno. M. D. xliv.





THE SURGEON'S LIBRARY

OLD MASTERPIECES IN SURGERY

By ALFRED J. BROWN, M.D., F.A.C.S., Omaha

THE BYRTH OF MANKYNDE

IN spite of the fact that the minds of the English people had been centered on the desire for an heir to the British throne since the early years of the sixteenth century, and this same desire must have been present in the medical profession as well as the laity, no strictly medical attention had been paid to the science of obstetrics. A fifteenth century manuscript exists in the British Museum but so far as known had never been printed. It is interesting to follow the story of Henry the Eighth and speculate on the origin of the most famous work on obstetrics in the English language which held its pre-eminence for over one hundred and thirty years.

Henry the eighth, he of the many wives, in the early part of his reign married his brother's widow, Catherine of Aragon. Their child was a girl, the Lady Mary, and after the king despaired of a male heir he finally divorced Catherine and in 1533 married Anne Boleyn. This marriage failed to produce a male heir and in 1536, after a trial in which Anne was found guilty of adultery, she was condemned to death and beheaded. The following day Henry married Jane Seymour who in 1537 gave birth to Edward the Sixth. There was great rejoicing that after a wait of twenty-eight years an heir to the throne had arrived but there was subsequent sorrow when, twelve days later, the queen who had produced this heir, died of puerperal fever. Did this series of events turn the minds of British medical men to the necessity of the study of obstetrics? For it was but three years later that the "Byrth of Mankynde" first appeared.

As this question of the origin of the book is but a speculation so there is a mystery in the book itself. Its author is not known definitely and there is likewise ground for disagreement as to the printer. The first edition appeared in 1540 and was a translation into English of the Latin form of "Roesslin's Rosegarden" (1513) which appeared under the title "De Partu Hominis." The claim to this English translation is made by one Richard Jonas and it was printed by one T. R. who was probably Thomas Raynalde, a well known printer of the sixteenth century who 'dwelt in St. Andrew's Parish, in the Wardrop, and kept shop in St. Paul's churchyard.' To this edition Thomas Raynalde the physician, had no claim, for it is very doubtful if Thomas Raynalde the printer, and Thomas Raynalde the physician, were the same. In the second edition, that of 1545,[1] Richard Jonas drops out of the picture except for anonymous mention in the prologue and Thomas Raynold phisition, whose name appears on the title page as the author, enters. He claims no originality for the book for in the prologue he says "wherefore now to come to oure pourpose, ye shall understande, that abougth a thre of foure years passyd, a certayne studious and dilygent clarke, at the request, and desyre of dyvers honest and sadde matrones beynge of his acquayntaunce, did translate out of Latin in to Englysshe a greate part of his booke entytlinge it accordynge to the Latine inscription (de partu hominis, that is to say of the byrth of mankynde) which we dò nowe name the (The woomans booke)." He states that this translation did not vary from the original Latin but that he, Raynalde, was changing it somewhat. The changes appear to be mostly in the anatomy which appears to follow that of Vesalius whose "De corpris humani fabrica," 1543, was in direct contradiction to the then prevailing Galenic anatomy. In the table of the first book he refers to eleven anatomical figures which are copper plates that follow the Vesalian anatomy. The other illustrations are copper plates depicting the "woman's stoole" or obstetrical chair and the seventeen "birth figures" which follow Roesslin very closely and, like the text, were probably copied from his Rosegarden. Roesslin, in turn, had obtained them from one of the early manuscript copies of the obstetrical work of Soranus of Ephesus who lived in the second century A.D. This work had been passed down through the centuries by means of the various Soranus—Moschion codices and was the authoritative work on obstetrics up to the appearance of the Rosegarden. These copper plates are poorly executed and are not by the same engraver as the "Geminus" plates. However, as they appeared in the Jonas edition of 1540 they have the distinction of being the first copper plates printed in England.

The book is printed throughout in black letter and contains 149 pages. In addition to the anatomy and description of positions of the fetus and the care of labor, it contains many recipes and directions for the cure of various complaints scattered through it, among others "to keep and preserve the teath cleane"; "Of stykynge breath," etc.

Written rather for the laity and midwives than for the medical profession the book was reprinted often, and the final edition appeared in 1676.

[1] Courtesy of Dr. LeRoy Crummer, Omaha, Nebraska.

REVIEWS OF NEW BOOKS IN SURGERY

IN the Goulstonian Lectures by Ryle,[1] which appear as a monograph, an attempt is made to clarify the subject of gastric function and responses. The text is divided into three parts covering normal gastric responses, gastric responses in disease, and the classification and symptomatology of the common dyspepsias. The author advances a number of conclusions which are hypothetical deductions made from clinical and laboratory observations on man but not proved by animal experiments.

J. A. WOLFER.

MILES, in his recent monograph on cancer of the rectum[2] presents this vital subject in a most interesting and logical manner. Perhaps no surgeon of today has had a greater experience in treating cancer of the rectum; and I would judge from a careful reading of this little book that no surgeon has studied this subject with a clearer conception of cancer in general and cancer of the rectum in particular. The work is profusely illustrated. The symptoms and pathological classification are discussed in a lucid manner. The most interesting and instructive part of this little monograph is that dealing with the surgical treatment. The author from his personal experience and study has gradually evolved an operative technique "based on a knowledge of the demonstrable facts of pathology" and he performs "the most extensive operation possible in conformity with that knowledge," in all cases, "no matter how small or early the local manifestation of the disease may seem to be."

J. A. WOLFER.

A SPLENDIDLY written small volume on surgery[3] from the pen of the master surgeon, Rutherford Morison, is intended for the general practitioner. The author's premise is that "the fate of a patient, the victim of an abdominal emergency, depends chiefly upon the skill and promptitude of his doctor, rather than upon special surgical skill." The subject matter is treated under three headings: abdominal emergencies, subacute abdominal diseases, and chronic abdominal diseases. Well selected case histories cited from the author's rich experience help to emphasize salient points in diagnosis.

GEORGE HALPERIN.

A VOLUME entitled *The Melanomata*[4] presents the results of (1) an intensive histological study of cell origins and transformations, made with the hope of throwing light upon the diagnosis of numerous growths of atypical melanomata so that the earliest malignant changes may be recognized; (2) a review of the clinical course and manifestations of an extensive series of benign and malignant melanomata, with the formulation of clinical deductions; and (3) a critical discussion of certain aspects of the histological and etiological phases of tumor growth. It is based upon an examination of 157 melanomata from human sources and a smaller number of similar tumors from the calf, sheep, and horse, together with a study of the presence and formation of melanin in various locations in man and animals where it is normally found.

The author is convinced that the formation of melanin is a specific function of the cells of the basal layer of the rete malpighii of the skin. These cells, the "melanoblasts," maintain throughout their existence the function of producing pigment and they transmit this characteristic to their descendants. The "melanophores" or "chromatophores" found in the corium merely transport pigment but do not produce it.

Dawson thus adopts the view of Unna and others that the simple melanomata have their origin in early life or at puberty in the basal cells of the surface epithelium or rete epithelial processes. These basal cells, losing their essential epithelial morphological characters, migrate into the corium where they maintain their capacity to produce melanin and become "nævus cells." These cells differ, therefore, from the chromatophores of mesodermal origin from which Kölliker in 1860 and later Ribbert derived the melanomata. The malignant melanomata usually have their origin in a benign pigmented nævus. The tumor cells arise from two sources: (1) from a proliferation of the original nævus cells embedded in the corium; and (2) from cells of the surface epithelium and its interpapillary epithelial processes by a series of transformations analogous to those traced in the genesis of a simple nævus.

On clinical grounds, Dawson divides the melanomata into:

I. Cutaneous melanomata (139 cases)
   1. Benign melanomata
      (a) Nævus-celled type (29 cases)
      (b) Acanthotic type or pigmented warts (37 cases)
   2. Benign melanomata showing increase in size (6 cases)
   3. Melanomata showing definite transitions to malignancy (36 cases)
   4. Malignant melanomata with gland involvement (31 cases)

II. Ocular melanomata (18 cases)

This book is exceptionally well illustrated. Seven pages of bibliography with complete titles and references add much to its value. The author is never

[1] GASTRIC FUNCTION IN HEALTH AND DISEASE. By John A. Ryle, M.D. (Lond.), F.R.C.P. New York: Oxford University Press, 1926.

[2] CANCER OF THE RECTUM. Being the Lettsonian Lectures Delivered before the Medical Society of London, on February 19, March 7 and 26, 1923. By W. Ernest Miles, F.R.C.S. London: Harrison and Sons, Ltd., 1926.

[3] ABDOMINAL AND PELVIC SURGERY FOR PRACTITIONERS. By Rutherford Morison. New York: Oxford University Press, 1925.

[4] THE MELANOMATA; THEIR MORPHOLOGY AND HISTOGENESIS; A STUDY OF CELL ORIGINS AND TRANSFORMATIONS WITH CRITICAL DISCUSSION ON ASPECTS OF TUMOR GROWTH AND A CLINICAL REVIEW. By James W. Dawson, M.D., D.Sc., F.R.C.P.E. Edinburgh and London: Oliver and Boyd, 1925.

dogmatic. He presents his observations and the deductions therefrom with clearness and directness. The attempt to correlate the clinical data and histological findings is thoroughly critical and illustrates the difficulties of such a procedure. Many other important phases of melanomata and melanin formation are discussed but cannot be even mentioned here. This volume is an interesting contribution to the subject.

J. P. SIMONDS.

CURRENT medical literature has supplied many contributions to the surgical aspect of colonic and rectal tumors, but no monographs since Harrison Cripps' so adequately illustrates the pathology of the disease as the one by Lynch and Felsen.[1] Full page illustrations showing gross specimens with inserts of the histopathology are faced on opposite pages by a brief clinical history of the disease and a pathological description of the specimen. This management of the material is much like that employed by Mr. Choyce in his surgical library, where the gross specimens are flanked by the microscopic slides and the clinical history of the patient while the literature of the subject is on the shelves close by. An atlas of the pathology of the cancer of the large bowel is in this way developed. The interspersed text includes a complete survey of the lymphatic drainage of the large bowel and emphasizes its importance in the radical surgical removal of cancer of the large bowel. The chapter on embryology, anatomy, and physiology is brief but adequate.

Perhaps no subject in surgery presents more points of controversy than the treatment of carcinoma of the rectum. No standard procedure exists. Criticism of the authors' views would therefore be only in the nature of an argument. Preservation of the anal sphincter and re-establishment of continuity of the bowel after radical removal of cancer of the rectum are not, however, generally accepted principles of surgical procedure.

This monograph is a valuable contribution to the subject and because of the emphasis placed on the pathology and anatomical features of the subject, the book will lead to earlier diagnosis and a clearer understanding of the principles underlying the treatment of cancer of the large bowel.

VERNON C. DAVID.

A NEW work has appeared on chronic pancreatitis with jaundice.[2] The condition is treated as a definite syndrome from the illy classified lesions of the gland. Following a thorough review of previous reports on this condition, Mallet-Guy carefully describes the different anatomical and histological forms which he considers of great importance in a diagnosis at operation.

The well known causes of chronic pancreatitis with jaundice such as cholecystitis with or without stone which may have been passed, and the various infections of the biliary tract apparently do not explain all the cases of this character which present important pathogenic problems.

The author's clinical observations are quite convincing. They are followed by diagnosis and a discussion of the treatment. Stress is laid on the necessity of biliary drainage, the value of cholecystostomy and other operations on the gall tracts which permit drainage to the outside or to the alimentary tract or through the ampulla.

Favorable final results of cholecystogastrostomy are reported in 9 cases checked by means of the duodenal tube and X-ray with barium. The roentgenograms show plainly the bile excretion from the fundus of the gall bladder where it is attached to the lesser curvature of the stomach proximal to the pylorus.

In the main the author favors the use of cholecystostomy not only as a therapeutic measure but as a method of confirming the diagnosis of chronic pancreatitis. The monograph conveys an impression of careful work and is a noteworthy addition to our clinical knowledge of chronic pancreatitis.

KELLOGG SPEED.

FROM the anticancer center at Villejuif comes a monograph on the radium cure of cancer[3] with the admission that in spite of our rapid progress in this therapy it is still not easy to formulate exact rules and laws for the treatment of cancer by radium.

In the first part, the physical properties of radioactive substances and radium in particular are covered. There follows a chapter on the pathological anatomy of cancer, especially in regard to the cellular reaction to radium. A brief description of clinical diagnosis of all forms of cancerous growths ends the second part. In the third part, the modern ideas on the radiosensibility of the various body tissues are well covered. The fourth part deals with the methods of application of radium and treatment in general with this agent. This part is illustrated by photographs of patients suffering mostly from epithelioma of the skin, but explains with case illustrations and autopsy findings the value of radium therapy in all forms of malignant growths.

The monograph consequently offers the theory, biological action, and practical employment of radium for cancer, and thus presents the physician and surgeon with a valuable ready reference.

KELLOGG SPEED.

THE value of one man's experience is enhanced by the written record of his observations. In a monograph which has recently appeared on the diagnosis and treatment of tuberculosis of the hip,[4]

[1] TUMORS OF THE COLON AND RECTUM; THEIR PATHOLOGY, DIAGNOSIS AND TREATMENT. By Jerome M. Lynch, M.D., and Joseph Felsen, M.D. New York: Paul Hoeber, 1925.

[2] PANCRÉATITES CHRONIQUES AVEC ICTÈRE (CAUSES, DIAGNOSTIC ET TRAITEMENT) VALEUR ET RESULTATS ELOIGNES DE LA CHOLECYSTO-GASTROSTOMIE. Preface de M. le Professor Bérard. By Dr. Pierre Mallet-Guy. Paris: Masson et Cie., 1925.

[3] LA CURIETHERAPIE DES CANCERS. By Simone Laborde. Paris: Masson et Cie., 1905.

[4] THE DIAGNOSIS AND TREATMENT OF TUBERCULOSIS OF THE HIP. By G. R. Girdlestone, B.M. (Oxon.), F.R.C.S. New York: Oxford University Press, 1925.

Girdlestone reflects valuable experience. The book is enriched by selected illustrations and should be read by every medical man because the early recognition of this deadly and deforming disease renders it amenable to curative treatment.

The author's easy style, his classification, and his logical discussion of treatment, make an excellent epitome of the subject. KELLOGG SPEED.

TOO infrequently the Medical Society caters to the classical paper. A noteworthy exception exists in the Wayne County Medical Society (Detroit) which by the terms of the Detroit Orthopædic Lectureship Fund distributes its first lecture, The Evolution of Orthopædic Surgery.[1]

This small monograph is a classic and will be thankfully received by all libraries, publications, and societies. The orthopedic student must turn to it for a résumé of the history and progenitors of his chosen work. KELLOGG SPEED.

THE monograph by Orr dealing with modern methods of amputation[2] is a very concise outline of the general principles of this branch of surgery. The author makes no pretense of establishing any original methods. He has confined his discussion to those methods that are practical and workable. Thoughtfulness is shown in his omission of many of the obsolete and fantastic operative procedures that clutter up the pages of most surgical textbooks. There is little to criticize and much to commend in this very brief work. More monographs of this type would greatly facilitate the work of the occasional operator by emphasizing important points and not confusing the reader with too much detail. R. W. MCNEALY.

DR. FISHER[3] presents to the medical profession a discussion of the importance and value of manipulative surgery in the treatment of carefully selected cases, of certain sequelæ of injuries and diseased joints, muscles, tendons, and fascia. He states that failure of the profession to grasp the truth of these statements causes the public to flock to bonesetters and other uneducated members of cults. He recognizes the honest men who have tried to place this therapeutic measure on a scientific basis and devotes brief space to the historical circumstances which led to the treatment of these conditions by prolonged rest.

A brief description of the surgical anatomy and the normal movements and range, precedes the technique of the manipulation of each joint.

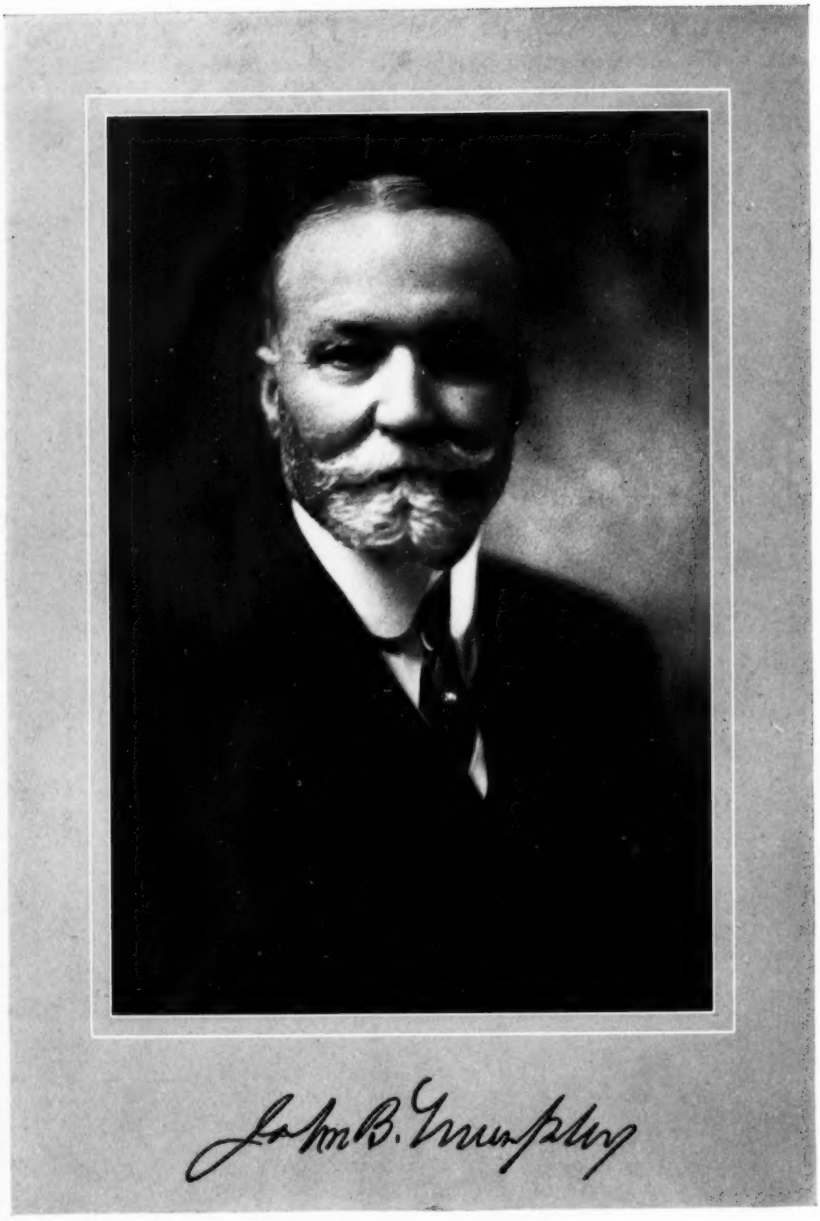
Emphasis is placed on the importance of early movement and massage following the injury or following manipulation under anæsthesia in neglected cases, for the prevention of adhesions.

[1] THE EVOLUTION OF ORTHOPEDIC SURGERY. By Robert Bayley Osgood, A.B., M.D. St. Louis: The C. V. Mosby Co., 1925.

[2] MODERN METHODS OF AMPUTATION. By Thomas G. Orr, A.B., M.D., F.A.C.S. St. Louis: C. V. Mosby Company, 1926.

[3] MANIPULATIVE SURGERY; PRINCIPLES AND PRACTICE. By A. G. Timbrell Fisher, M.C., F.R.C.S. (Eng.). New York: The Macmillan Company, 1926.

UNIV. OF MICH.



John B. Gramling

AMERICAN COLLEGE OF SURGEONS

DEDICATION AND INAUGURATION OF THE JOHN B. MURPHY MEMORIAL

THE completion of the Murphy Memorial marks an epoch in the history of the American College of Surgeons. Two evenings, June 10 and 11, were occupied with its dedication and inauguration. The first evening was under the supervision of the John B. Murphy Memorial Association, with Mr. Leroy A. Goddard, the president of the association, as presiding officer. The ceremony was begun by a procession to the platform of officers of the Murphy Memorial Association and the American College of Surgeons, and distinguished guests, preceded by the bearer of the Mace, symbol of authority of the College. Following the playing of the national anthem, the invocation was pronounced by the Reverend William H. Agnew, S.J., president of Loyola University, as follows:

"Almighty and Everlasting God, Omnipotent Author and Benignant Owner of the universe, recognizable as such with scientific certainty by the human intellect that fairly views the world and honestly traces back phenomena to their adequate and ultimate origins, we are assembled here this evening to dedicate to the service of humanity a new instrumentality of mercy and enlightenment in memory of one who always believed in Thee, and worked always in Thy Holy Name. Grant that those who are to administer this noble institute may always reckon themselves as the stewards and dispensers of Thy bounty and the responsible agents of Thy mercy. Grant that those who will study and labor within these walls for the betterment of human kind may always be mindful of Thy warning and Thy charge: 'Whatsoever you do to the least of my brethren, you do to me.' Likewise we pray Thee, give to those who will write and deliberate within these halls the gifts of wisdom, sure knowledge, honesty and loyalty; wisdom, knowledge, honesty and loyalty that will make them the beneficent dispensers of truth, and the safe guides of genuine research, and that will save them from the blasphemous stupidity of invoking the very evidences of Thy handiwork in disproof of Thy existence and in destruction of man's highest dignity and supremest hope, which are that we are Thy children and the heirs of an eternal destiny. Amen."

The John B. Murphy Memorial building was formally presented to the American College of Surgeons by the president of the Murphy Memorial Association and was accepted in behalf of the College by its president, Dr. Rudolph Matas.[1]

Because of the fame of Doctor Murphy and the recognition of the importance of the work being carried on by the College, of which Doctor Murphy was a founder and Regent, the civic and educational organizations in the city of Chicago were represented, and there were present to participate in the ceremony many famous surgeons of the United States and Canada. To those who cooperated in making possible the Murphy Memorial, the presiding officer expressed the appreciation of the Memorial Association as follows:

"Before introducing the speaker of the evening I desire to give expression of our appreciation to the many units that have co-operated with us for the success of these exercises. We have here representatives from the following educational institutions: Northwestern University, University of Wisconsin, University of Illinois, Notre Dame University, University of Michigan, University of Chicago, and St. Ignatius College. Doctor Murphy was directly associated with or received honors from all these institutions. We are honored by representatives from the State, County and City Governments. We appreciate especially the presence of so many of the County Commissioners, and several of the members of the Mayor's cabinet. In this connection I mention also with much pleasure the following clubs of Chicago: Chicago, Chicago Woman's, City, Fortnightly, Industrial, Kiwanis, Rotary, and the Union League. The last named Club appointed fifty-three

[1] Addresses appear in full in following pages.

delegates, and its president, Harry Eugene Kelly, is attorney for the Chicago Medical Society. The Chicago Association of Commerce, one of our most influential supporters, appointed thirty-four delegates. Its president, Mr. William R. Dawes, one of the busiest of business men, is here heading this delegation. It has a companion in the Illinois Manufacturers Association, whose long time secretary and successful pusher, Mr. John M. Glenn, is here with its representatives. Mr. Glenn has proved one of the most useful members of the executive board of our association. I mention also the presence of representatives from the Chicago Bar Association and the Ohio Society. Time will not permit more than the mere mention, though just as important and just as fully appreciated, that we are favored with delegates from ten medical societies and from all the leading hospitals in Chicago."

In introducing Dr. William J. Mayo, the principal speaker of the evening, the President said:

"I know it is a delight to you all to have this opportunity to listen to one of the most interesting men of this period, and one whose name and reputation are internationally known. Many of us heard the splendid address that he delivered at the laying of the cornerstone of this building. He has graciously favored us again with his presence. I present our neighbor from the West, the distinguished surgeon, Dr. William J. Mayo, of Rochester, Minnesota."

Dr. Mayo spoke on "The John B. Murphy Memorial, the Atheneum of Surgery."[1]

The ceremony was brought to a close by the playing of the "Star Spangled Banner," and an informal reception for the audience, among whom were the daughters of Doctor Murphy.

THE inauguration of the Memorial by the American College of Surgeons took place on the second evening, Friday, June 11, with the president of the College, Dr. Rudolph Matas, as the presiding officer. A formal procession of the officers of the Memorial Association and the College, distinguished guests, and Fellows of the College in the academic gown and cap, headed by the Mace bearer in the uniform of the United States Army, opened the meeting. The orchestra rendered the national anthem, whereupon the following invocation was pronounced by the Reverend Duncan H. Browne, S.T.D., rector of St. James Church:

"In Thy presence, our Father, we stand tonight to dedicate this temple to the pursuits of scientific research in medicine and surgery. The building bears the name of one who gave himself without stint to the service of mankind—John Benjamin Murphy—devoted husband and father—faithful friend—loyal and patriotic citizen—a teacher with a keen insight into the truth—a skillful minister to the relief of the diseases and ailments of human kind.

"May this building ever stand as the symbol of all that is best and noblest in the practice and profession of medicine and surgery! May it inspire to break down prejudice and ignorance by the clear rays of truth and knowledge. May its ideal to serve God and minister to the needs of humanity ever remain the foundation stone upon which it is built and its ideals maintained. In that light shall we see light. In so dedicating this temple of light we bespeak the divine guidance and the blessing of Him who taught that inasmuch as we do it unto those least we do it unto Him—our Lord and our Saviour Jesus Christ. Amen."

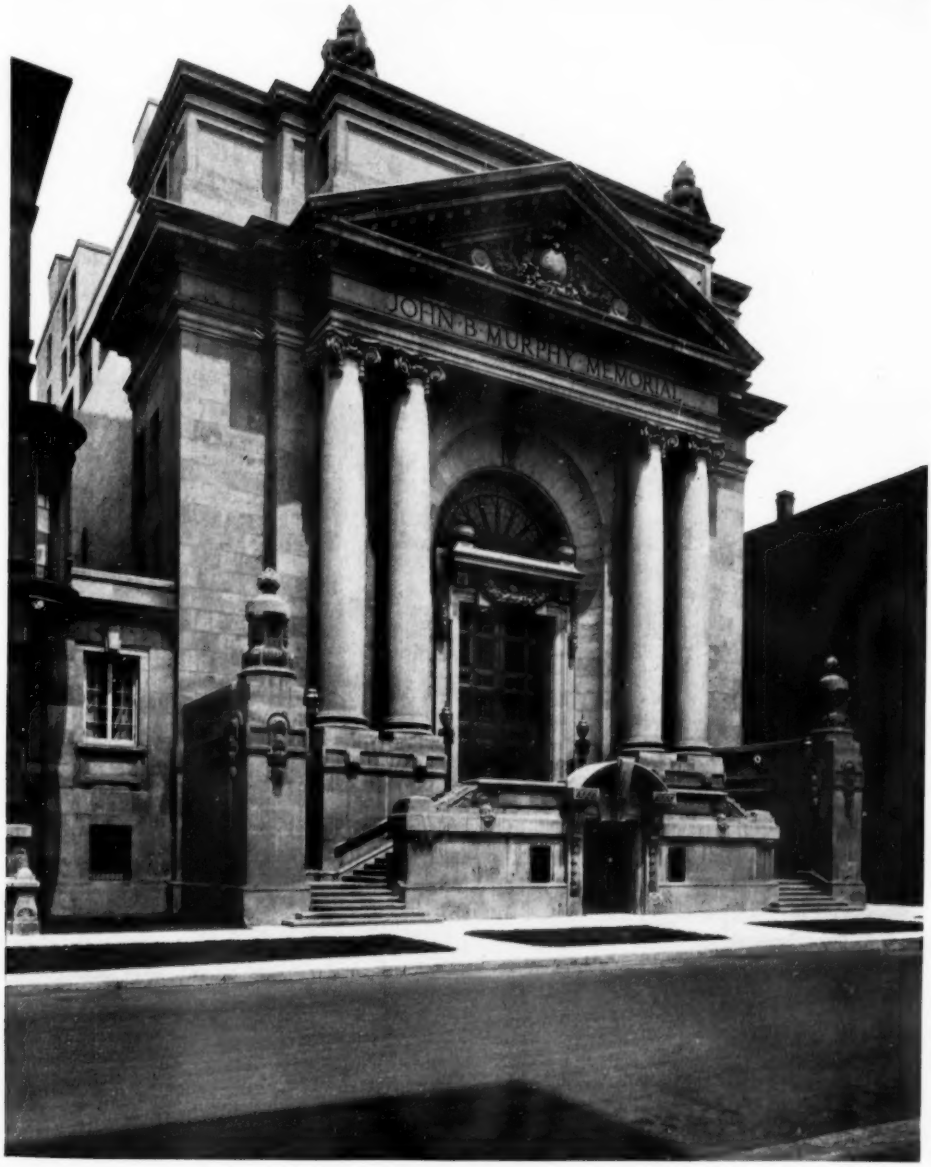
The President's introductory remarks follow:

"The Fellows of the American College of Surgeons who represent the thought and aspirations of the surgeons of America, have assembled here tonight to voice, through the utterances of their most distinguished leaders, the sentiments of gratitude that animate the College in accepting the noble edifice that the relatives, friends, and admiring colleagues of Doctor Murphy have dedicated to his memory and to the service of surgery.

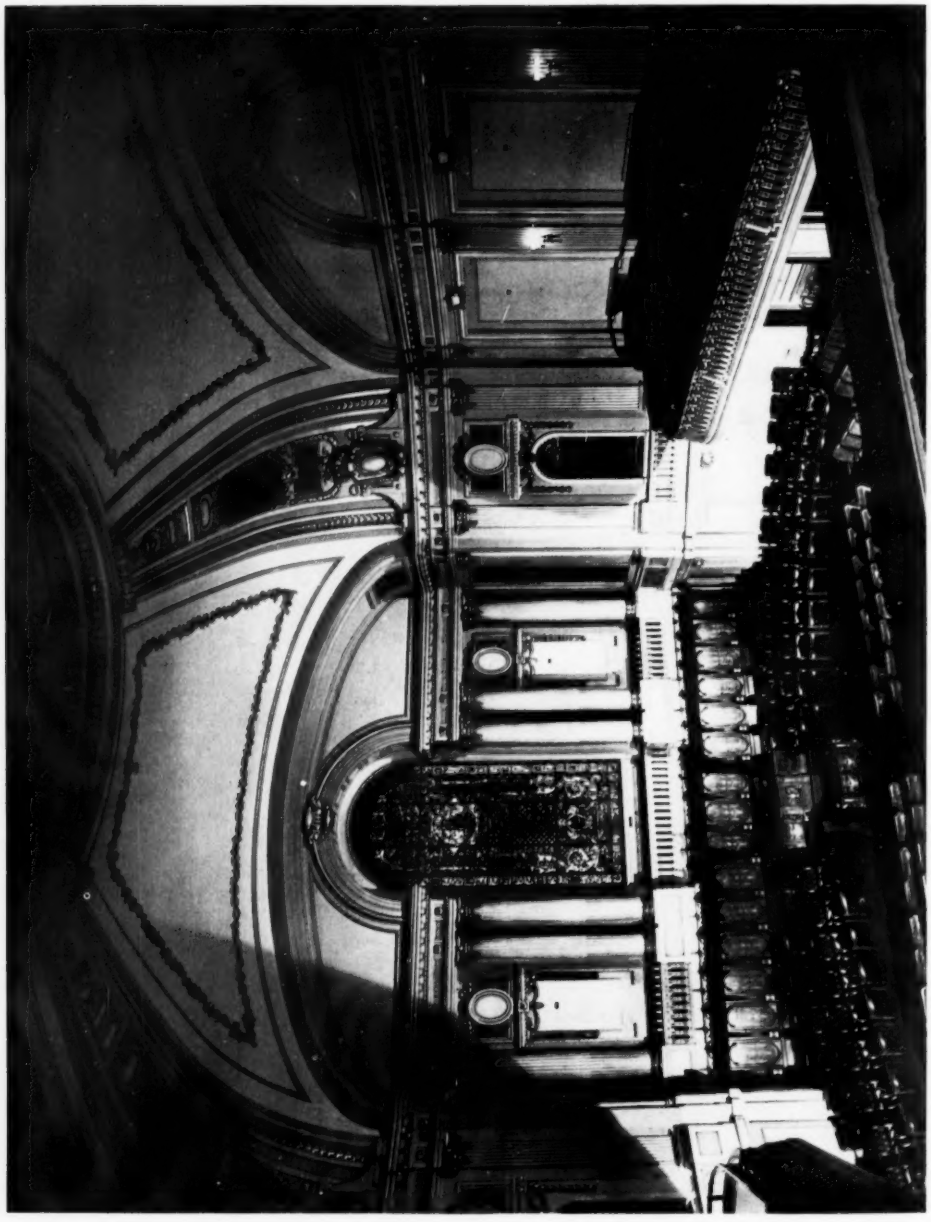
"In grateful recognition of the generous motives that have prompted the John B. Murphy Memorial Association to transfer this monumental testimonial of their love and admiration for the great surgeon, whose name it bears, to the permanent care and custody of the American College of Surgeons, the College will now celebrate the first public session held under its auspices in this memorial hall. Availing themselves of this memorable opportunity, the speakers who will address you will confirm their faith in the purposes and ideals of the College and renew fidelity to its pledges and to the fulfillment of its obligations.

"Doctor Murphy's life and labors in their relation to the American College of Surgeons and to the progress of the science and art of surgery as developed in America, have been

[1] Addresses appear in full in following pages.



John B. Murphy Memorial.



Interior of Auditorium Showing Stained Glass Window.

told in a way that is too fresh in your memory of last evening's proceedings to require, at this moment, more than an added word to emphasize the service that he rendered in exalting and glorifying surgery by his teachings and example. It is in the prosecution of his high aims and ideals through the instrumentality of this priceless possession that the College will render the most faithful tribute to his memory.

"It is to the further expansion of the altruistic purposes of this organization in serving the highest interests of humanity through the ever growing, ever changing, ever advancing, and ever conquering forces of modern scientific medicine, that the proceedings of this session will be formally consecrated.

"In calling for the first number on the program we are happy to recall that there is no one in our guild who lived closer to the thoughts of the great master and who sympathized more respondingly to the noble spirit that animated him, or who promoted and gave form to his aspirations and ideals, than the friend and colleague whose genius for organization and leadership has given life and movement to the great enterprise that we now visualize in the mission and functions of the American College of Surgeons. To renew the pleasure that it gives us to acknowledge the unpayable debt that we owe to the originator and organizer of our association, I am now happy to present the Commanding General of our Army as the best fitted to initiate the proceedings of the evening,—Dr. Franklin H. Martin."

Dr. Martin spoke on "John Benjamin Murphy—Citizen and Surgeon."[1]

Dr. George W. Crile, of Cleveland, whose subject was "The American College of Surgeons"[1] was introduced by the President, who said:

"Throughout the fourteen years that have elapsed since the foundation of the American College of Surgeons, a great surgeon and a great personality in American surgery has stood by the helm of this institution and brought to bear upon its administration all the light that his gifted intelligence and the incalculable wealth of his scientific knowledge could give to the guidance and support of its aims and functions. I have the honor to present to you one of the greatest assets of the American College of Surgeons and one of the outstanding, most original and prolific contributors to the progress and prestige of American surgery—Dr. George W. Crile."

[1] Addresses appear in full in following pages.

At this stage, the proceedings were agreeably interrupted by the entrance of Dr. Charles H. Mayo whose presence on the platform was the signal for a general outburst of applause. After responding in fitting terms to the warm welcome accorded him, Dr. Mayo proceeded, in behalf of the College, to present to Mr. Walter E. Carr a specially designed and engraved testimonial in parchment, attesting to the thanks and grateful appreciation of the College for his invaluable service in financing and erecting the Murphy Memorial. Mr. Carr did not spare time, thought, or labor in completing his task but worked with zeal and enthusiasm solely for the love of the cause and without thought of pecuniary compensation. Dr. Mayo's remarks follow:

"My present task is a most agreeable one. While we are here assembled to dedicate this beautiful memorial building, erected to the memory of that great surgeon and teacher, John B. Murphy, for the advancement of medical science, it is most fitting that we, at this time, acknowledge the work of Mr. Walter E. Carr in making our vision come true. The members of the Board of Regents, now that the construction details are over, appreciate the magnitude of the work and the importance of the detail which was the burden of Mr. Carr rather than the Board. We have appreciated his contagious optimism and enthusiasm at all times no matter how arduous were his duties.

"I now present to Mr. Carr on behalf of the members of the Board of Regents this record of their appreciation which states:

TO WALTER E. CARR

in recognition of his unselfish devotion, his persistent endeavor, and his untiring service in aiding and establishing the monumental

JOHN B. MURPHY MEMORIAL BUILDING

which commemorates one of the world's greatest surgeons, the Board of Regents of the American College of Surgeons has delegated us to express the thanks of the College, and has authorized us to place upon the walls of the Murphy Memorial a tablet attesting for all time this appreciation. In Witness Whereof, we have caused the Common Seal of the American College of Surgeons to be hereunto affixed this tenth day of June, Nineteen Hundred and Twenty-six.

(signed) RUDOLPH MATAS, *President*
(signed) FRANKLIN H. MARTIN, *Director-General*

In responding, Mr. Carr said:

"I can assure you it is not necessary for me to state that I am taken entirely by surprise, but I most deeply appreciate the great

Dr. Norman Bridge Memorial Bronze Doors.

honor that has been conferred upon me. And in your own more than kind words, Dr. Mayo, you have not lived up to your reputation for conservatism, but have readily exaggerated whatever it may have been my good fortune to have accomplished in connection with the work to which you have referred. To be associated in any way with the very distinguished men who comprise the Board of Regents of the American College of Surgeons is an honor, a very unusual honor, and most especially for a business man. So far as the work is concerned, it was not difficult, but was a pleasure throughout on account of the object—a memorial to Dr. John B. Murphy, and on account of the dignity of the work of the American College of Surgeons."

"Surgeons of America"[1] was the title of the presentation by Dr. W. W. Chipman, of Montreal, president-elect of the College, whose introduction by the President follows:

"One of the greatest aims of the American College of Surgeons has been to promote international relations and to foster the spirit of brotherhood among the men of our profession. From the very beginning of this institution it recognized no frontiers between the Dominion of Canada and the United States. The deeply rooted sympathies of race, language, and tradition have inseparably interlocked the professional interests of the Canadian profession and our own, and have fused these into a common mold. Ever since our foundation, the surgeons of Canada and of this country have moved together as a solid phalanx in the most perfect unity of purpose, sentiment, and action. Our administrative and executive offices are shared alike in a common Fellowship, and we glory in the achievements of the great Canadian leaders who have contributed so largely, so freely and so effectively, to the cause of our organization. Of this number, no one is better fitted to represent the loyalty and the service of the Canadian profession in aiding this College to the attainment of its mission than the distinguished leader, now our president-elect, whom I have the honor to present—Dr. Walter W. Chipman, of Montreal."

In presenting the last speaker of the evening, the President said:

"If there is merit in a life of service devoted to the unalloyed love of his profession and to the promotion of every movement that could tend to elevate and dignify it by the force of example, I know of none greater than the life and labors of the distinguished gentleman who is here as the representative of the medical culture of the greatest metropolis of the world. Thrice president of the New York Academy of Medicine, one of the ablest, most eloquent, and most inspiring masters of that center of medical learning—a plumed knight of our profession and one of the best loved members of our guild—Dr. George David Stewart, of New York."

Dr. Stewart spoke on "Three Decades in Surgery."[1]

With the playing of the "Star Spangled Banner" and an informal reception, the ceremonies drew to a close.

[1] Addresses appear in full in following pages.

DESCRIPTION OF THE MURPHY MEMORIAL BUILDING

The John B. Murphy Memorial Building is a monumental structure built of fireproof materials, faced with Bedford stone. It follows in design the French Renaissance period of architectural development and the exterior design was inspired by the Memorial Building in Paris. The building is set back somewhat from the street to set off the beautiful architectural motifs of the façade in the best way. The façade is featured by a pair of exceptionally designed and modeled bronze doors by Tiffany, presented by Mr. Edward L. Doheny as a tribute to Dr. Norman Bridge, who was a lifelong friend and a man of high repute in the medical profession. The bronze doors contain panels setting forth historic incidents and lives marking the various great steps of advancement in the history of medicine. These panels represent: Æsculapius, the god of medicine; Pasteur, a founder of scientific medicine; Osler, a great clinician; Lister, the father of modern surgery; McDowell, an American pathfinder in surgery; Gorgas, a world sanitarian. These bronze doors are at the top of an imposing flight of double stairs leading to the main floor of the building.

The main floor is taken up with the Memorial Hall. This auditorium is also French Renaissance in architectural treatment and is exceptionally impressive in its proportions with its high vaulted and ornamented ceiling. The color scheme of the room is ivory accented with gold. Blue is used in the draperies, floor covering and upholstering. An outstanding feature in the auditorium is the memorial stained glass window, directly opposite the main entrance and back of the platform, donated by Mr. C. H. Matthiessen, and executed by the Willet Company, of Philadelphia. This

stained glass window ties in beautifully with the color scheme of the room and has the feature of the seal of the American College of Surgeons. Below the stained glass window, the stage is largely treated with carved walnut paneling of exceptional merit and incorporates the seats for the Board of Regents and their president. A pipe organ is now being installed in the Memorial Hall. The interior of this room has been designed with the thought in mind to arrange as many spaces as possible for the installation of memorial paintings, tablets, busts, statues, etc., and still in no way to interfere with the impressive architectural treatment of the room. The main floor and balcony seat about 1,000 people. This auditorium is flanked on the south and west by a very impressively treated foyer carried out in the same architectural style as the auditorium, with numerous wall spaces and alcoves provided for memorial treatments.

The building contains on the ground floor a lecture hall with necessary foyers, having seating capacity of about 250. This assembly room and the larger auditorium will be open to gatherings of medical and other scientific societies. There is an additional room which is available for the beginning of the Clinical Research Department and Medical Museum of the American College of Surgeons.

The top floor of the building contains accommodations for literary research work with adequate library stack space and reading rooms.

SUMMARY

A brief review of the Murphy Memorial, from its inception to its completion, is given herewith:

The death of John B. Murphy on August 11, 1916, created among laymen and the medical profession a spontaneous demand that a suitable memorial be erected to commemorate his distinguished services to humanity and to the science and art of surgery. This demand was so imperative that a number of Dr. Murphy's friends considered it desirable to incorporate an association that could legally investigate the many plans suggested and crystallize these efforts in a way to obtain dignified and permanent results. Among the many plans for a memorial that fulfilled the ideals of the incorporators of the Association, one was paramount, namely that the memorial take the form of the John B. Murphy Memorial of the American College of Surgeons, as Dr. Murphy was a founder and the first chief of the editorial staff of SURGERY, GYNECOLOGY AND OBSTETRICS, now the official journal of the College; an organizer of the Clinical Congress of Surgeons of North America; and a founder and member of the Board of Regents of the American College of Surgeons, and in the activities of each of these organizations he was actively and earnestly interested. It was realized that such an affiliation assured permanency and that the memorial would become a living power for the advancement of surgery along scientific and moral lines and in form and use present an appeal to the people of Chicago and the continent that would satisfy them that their monument would perform a service that would be of benefit for all time to all people.

The entrance of our country into the great War scattered the incorporators and caused a temporary cessation of the activities of the Association. In the early months of 1920 the plan of providing a memorial was revived and the Association was reorganized as follows:

Officers: Leroy A. Goddard, president; Charles H. Wacker, treasurer; W. A. Evans, secretary.

Board of Directors: Walter E. Carr; W. A. Evans; Leroy A. Goddard; Edward N. Hurley; James E. Keefe, and Franklin H. Martin.

Building Committee: Albert J. Ochsner, chairman; Franklin H. Martin; Edward N. Hurley; W. A. Evans, and Walter E. Carr.

Executive Board: Edward Hines, chairman; Norman Bridge; Walter E. Carr; Edward F. Carry; Edward I. Cudahy; Charles G. Dawes; W. A. Evans; Samuel M. Felton; John M. Glenn; Leroy A. Goddard; John F. Golden; Edward N. Hurley; Samuel Insull; James E. Keefe; Franklin H. Martin; William J. Mayo; John J. Mitchell; Fred W. Upham; William Wrigley, Jr.

The moneys for the erection of the Memorial, contributed by physicians and surgeons and friends of Dr. Murphy, were assembled by the John B. Murphy Memorial Association. The construction of the building was begun, and the corner stone laid, with appropriate ceremony, on October 23, 1923. The dedication and inauguration, which marked the completion of the building, occurred on June 10 and 11, 1926.

Those who lived with Dr. Murphy—his contemporaries, his friends—appreciated him and sought to demonstrate their love by erecting to his memory a monument which, in the words of Dr. W. J. Mayo uttered at the laying of the corner stone: "is a fitting monument to the greatest surgeon of his day, John B. Murphy, one of the founders of the College, who gave unsparingly of his strength and talents to aid in the establishment of the organization, and whose noble spirit will always sanctify this ground."

PRESENTATION OF THE JOHN B. MURPHY MEMORIAL BUILDING TO THE AMERICAN COLLEGE OF SURGEONS, JUNE 10, 1926

By LEROY A. GODDARD, Chicago
President, John B. Murphy Memorial Association

WE have invited you here tonight to show you what has been done as a grateful tribute to the memory of Doctor Murphy.

I do not believe that there is any virtue in the human heart greater or brighter than gratitude. Much that we enjoy in our lives, not only of material things, but an endless measure of discoveries, developments, and unfoldments more durable than material things, have been prepared for us by those who have gone before. The debt of gratitude carries the same living obligation to those who have contributed to the sum of human achievements and have passed behind the veil as it does to those who are living and walking among us and the debt is just as great. It comes more natural oftentimes to show our appreciation to the living, for in so doing there may be selfish hope of further gain; but tributes to those who have passed on, and almost a decade ago, are without hope of future favors; consequently they are true and unselfish.

This memorial was well earned by Doctor Murphy and is the result of insistent demands from so many sources by those who knew his worth. Many of us who claimed his friendship socially did not fully realize before his passing what a force and of what great value he was to the medical profession, not only in the United States but in other countries of the world. He was not gifted in featuring himself in his conversation, in fact he was very modest. On the other hand his contributions to the surgical literature constitute almost a library in themselves. Tributes that have come from all sections of the world show that he was known by his works. Sir Berkeley Moynihan, the outstanding surgeon of England, expressed in a most polished classic memorial oration delivered in Montreal, his thoughts regarding Doctor Murphy, and I am using his exact words: "Murphy was beyond question the greatest clinical teacher of his day. No one who listened to him can ever forget the experience. . . . No one could bear to miss a word and while Murphy spoke no man left his seat."

We are justly proud of this structure, it should invoke the civic pride of every citizen of Chicago, and we want you to look it over before you leave. It may be information to you to know that there is not today in existence in any country a like monumental fabric that measures up to this one, especially in artistic beauty. This is a strong statement and I am going to make another almost as strong. The presentation of this building to the American College of Surgeons and its acceptance and dedication by that organization marks an important epoch in the history of Chicago. None of us can realize or form any kind of estimation of the far reaching and substantial value that this memorial will continue to be year after year in the future of our city. It establishes Chicago as the permanent headquarters of the American College of Surgeons, the leading association of surgeons in the Western Hemisphere and perhaps in the world. It will be the central meeting place of the surgical profession of the Western Hemisphere. Yes, and more, it will be open to all ethical medical and other scientific societies. Bear in mind, too, that the conditions of acceptance of this trust give assurance that it will be perpetuated for the purpose for which the building has been erected.

The American College of Surgeons is not exclusively a college proper, it is an organization devoted to the advancement of the art and science of modern surgery, as will be better told at the exercises of dedication here tomorrow evening. Doctor Murphy was a former president and one of the founders of the College, and was always intensely interested in its activities.

I know it is risky to mention names in connection with an undertaking of this nature, but I will venture to give expression of appreciation to Mr. Charles H. Wacker, whose name stands for so much in this community. As treasurer of the organization his name was all the assurance that the public needed that the funds would be properly handled. The association, too, was most fortunate in securing the services of Mr. W. E. Carr. While his title was that of secretary, he worked incessantly and effectively in every way to make this undertaking a success. Certainly too much praise cannot be given the members of the building committee: I mention especially Doctors Franklin H. Martin, William A. Evans, and the late Doctor Albert J. Ochsner, all busy men having their own affairs which demanded their attention, but they did not hesitate to give their time and help throughout every stage of the work.

While they necessarily had innumerable demands upon their time, yet, they patiently and successfully met the numerous problems that are always incident to such an undertaking.

It is a pleasure for me to express sincere gratitude to Marshall and Fox, the architects, not only for their extra care in every detail but also for generous contributions, and to Zander, Reum & Company, the plaster contractors, for their extremely satisfactory work. Much credit is due for timely and valuable help to such men as E. L. Doheny, C. H. Matthiessen, Edward N. Hurley, Edward Hines, and of blessed memory, the late Dr. Norman Bridge.

And now I feel wholly incapable of giving fitting expression to what should be said next. I wish that words would come to me that would give voice in the delicate loving terms that are demanded for what has been done by Mrs. Murphy and by the three daughters. It was Mrs. Murphy who made this memorial possible by making provision for a donation toward it of $100,000 contingent upon the raising of $400,000 more. It was planned that the raising of this $400,000 be divided into two parts; one-half to be assumed by the members of the medical profession and an appeal to be made to the public for the other half. Running true to form and to the spirit of the times it was discovered as the building progressed that a great deal more would be required to complete it as it should be than was originally planned. Doctor Murphy entered into rest in August, 1916, and Mrs. Murphy joined him in July, 1921. Considering this lapse of time and also that so many drives were and are being made for charity, for hospitals, for educational purposes and other causes of merit conducted by large organizations and by influential groups, it did seem we had reached the point when there was no further room for us in the Inn. This condition, however, was known only to the insiders, so to speak, and to the contractors. It was finally decided that the discouraging situation of the large deficit that appeared inevitable, should be made known to the three daughters of Doctor and Mrs. Murphy. It was hoped that they might supply as much perhaps as one-half of the amount required, and thereby inspire renewed energy to raise the balance. The daughters took the matter under advisement, but not for very long, and replied that they would not pay one-half of the balance; that they were not unmindful of the value of this tribute to their father and of its importance to this community in which their father had succeeded and where his friends were legion. They modestly and cheerfully stated that they would pay it all.

And now, the undertaking of the John B. Murphy Memorial Association is finished. As a corporation it will cease to exist leaving a successful history with every page a clean record. Here is the building and it is paid for. May it stand for ages as a valuable asset to the American College of Surgeons and the city of Chicago, and a testimonial of the love that we all carry for the memory of Dr. Murphy, which we will continue to cherish until the last note of time is sounded in our own lives.

On behalf of the Association it is a real delight to place this building into the custody of the American College of Surgeons, with the request that its president, Dr. Rudolph Matas, who is here from New Orleans, formally accept the trust.

THE ACCEPTANCE

By RUDOLPH MATAS, M.D., F.A.C.S., New Orleans, Louisiana
President, American College of Surgeons

THIS is a glorious day in the History of the American College of Surgeons; glorious in the realization of a cherished dream and more glorious in anticipation of the future service to humanity that this temple, dedicated to the cult of Surgery, offers to the faithful devotees of her Science and of her Art. It is a day of supreme joy to the thousands who lived close to the radiant soul of John B. Murphy and who loved him for what he taught and what he did for them and for the welfare of his fellows. They are happy to know that his precepts, his teachings and example are to be perpetuated in this incomparable monument to his greatness. It is a proud day for this great city of Chicago, the home and theater of the master's greatest triumphs, when, in honoring him as one of the foremost and most brilliant of her sons, she has exalted her conception of the beautiful by adding this matchless gem of architectural beauty to the crown of her choicest civic possessions.

Love, gratitude, and reverence for the dead have expended incalculable sums of money to perpetuate the memory of those most loved and most distinguished, on costly tombs, mausoleums, and monuments. Many of these have crumbled into dust, many have lost with time their significance and many have ministered chiefly to family vanity. Whether the money expended on such personal memorials has yielded an adequate or best return is questionable.

With greater enlightenment and the development of education which is the nursery of civilization, of learning, and of wealth, an increasing number of men and women have become convinced that the memory of the dead can be best preserved by a memorial building devoted to the welfare, not only of contemporaries, but also of endless generations of posterity.

Hence, numerous memorial buildings, alive with hope, faith, and charity, have risen throughout our country, consecrated either to the relief of suffering or to the cultivation of knowledge whereby suffering is best alleviated and mankind's welfare is best promoted.

This great city, the capital of northwestern civilization in the United States and a luminous center of medical thought, has been blessed with innumerable memorial buildings of this character. Many thousands of people have been and many more thousands of its people will be thereby rescued from sickness, destitution, and ignorance, and these many thousands will cherish in grateful memory the dead, whose good deeds still live, "where lifeless hands continue daily to distribute to the needy inestimable benefits, such as no chilling, barren, creation of uninhabited masonry can ever emulate." As numerous and valuable as have long been the donations to education, it is only in the last half century that a growing, but yet relatively small, number of philanthropists have manifested adequate appreciation of the incalculable benefits to humanity of medical knowledge and the need of fostering and developing the spirit of investigation and research in every department of knowledge that can lend greater power and certainty to medicine in its eternal warfare against disease and death.

In this way, universities, institutes, hospitals, laboratories, schools, and professorial chairs have been and are being endowed by individual or public philanthropy which are expanding the horizon of medicine through the civilized world; but in none with more initiative, munificence and vast breadth of purpose than is displayed by the enlightened and generous givers of this God-favored land of ours.

In expression of the same thoughts and purposes, we are assembled here today to dedicate a noble edifice to the service of Surgery and in doing this to commemorate the life and labors of one of her most honored apostles. This memorial, unique in its kind and unsurpassed in its beneficent intent, owes its existence to the communion of many souls which, united by a bond of common sympathy, have touched the magic spring that has given their affections this material form.

The hearts filled with love for the adored husband and father, and for the trusted friend; the hearts of the sufferers filled with gratitude for the life saved and the happiness restored by the master's hand; the hearts of the surgeons of America still thrilled and throbbing in remembrance of the vibrant voice of their dead, but ever-inspiring leader; the hearts of a great people overflowing with pride and emotion in the achievements of their world-renowned fellow citizen—all these diverse elements have come together and brought their contributions as votive offerings on the

altar of their affections and, in this way, the miracle of beauty that we now contemplate has come to pass.

The name of John Benjamin Murphy is now linked for all time with the American College of Surgeons, not only by the name inscribed in the façade of this Memorial but by the indelible imprint that his creative mind and stirring personality have left in the history of this organization as one of its prime movers and founders.

I am not here to pronounce a eulogy on Dr. Murphy, or to review his achievements as a surgeon, investigator, a teacher, or as a man. This task has been assigned to others who have far greater claims to this privilege, but it is appropriate, I believe, that I should give some account of his relations to the American College of Surgeons and to the profound influence that he exercised upon its course and policies throughout its existence and as long as he lived.

The American College of Surgeons as the exponent of the most authorized opinions of the surgical profession of this country was called into existence, nearly fourteen years ago, to meet a demand for improvement and reform in the conditions under which surgery was being practiced and which had led to evils that were threatening the good name and the progress of Surgery. Incompetence, defective education, and inadequate technical preparation for the responsibilities of the surgeon, together with a widespread tendency to exploit the resources of the Art for sordid and unscrupulous motives, had bred a spirit of graft which was steadily undermining the high ideals of Hippocratic purity, honesty, and square dealing which have guided the conduct of medical men throughout the ages. The purpose and mission of the College were therefore to elevate the status of surgery, to estabish new standards of competence and character for the practitioner of surgery and to educate the public and the profession to understand that the practice of surgery calls for special training and educational qualifications that distinguish the practice and culture of surgery from a mere craft, and elevate it to a highly differentiated specialty of medicine. The College, in endeavoring to protect the public from the abuses of the unqualified, has had to establish definite standards of proficiency and of conduct. In order that the public may discriminate between the fit and the unfit, it has created a title which distinguishes the qualified professional surgeon from the amateur and the fake. This is what the title, *Fellow of the American College of Surgeons*, means to the medical profession and is intended to convey to the public mind. In its efforts to elevate the standards of the surgeon, the College has had to concentrate upon his environment—the hospital—as well as upon himself, and that is why the great movement for standardization and reform which embraces so large a part of the activities of this College, was primarily undertaken. It was evident that the purification of the surgical body so intimately linked with its environment for the proper exercise of its function could never be accomplished without the thorough cleansing of both.

In the discharge of its ethical and educational mission, which was its primary function, the College has not lost sight of other great problems within its province to study and develop, and, if possible, to solve.

In the origin of the College and in the promotion of its ideals of service, Dr. Murphy was one of its most ardent promoters and constant advocates. In at least four of the great enterprises in which the College has been engaged since its inception, Dr. Murphy was largely instrumental in bringing them to a successful accomplishment. Himself an unsurpassed master of the clinical, objective, or demonstrative method of teaching, he made possible—through his own enthusiasm and the influence of his great name—the launching of that colossal enterprise known as the Clinical Congress of Surgeons of North America, which had its beginning in Chicago in 1910 and has become one of the most important factors in developing the educational features of this College. In his presidential address at the Clinical Congress held in Boston, in October, 1915, only nine months before his untimely death, he had occasion to verify his prediction that the Clinical Congress would become one of the most useful and practical agencies for the development of surgery in this country. The privileges which the best organized and most effective surgical clinics of the great cities afforded the individual, by seeing the work of others and comparing it with his own, immediately gave the movement an impetus that has carried it everywhere in the Western continent. The scope of the clinical movement was made not only national but international, including all the countries of North America and by the invitation of the English surgeons it extended to the British Isles as shown by the attendance of over 1,000 American surgeons at the London Congress of 1914, who were led across the seas by Dr. Murphy as their president. The idea that he upheld was, that: "The teaching of surgery and medicine by living demonstration at clinical meetings should be international and world-wide if the best results for the improvement of all are to be obtained.

Through its multiple and varied clinics which bring the most accomplished masters in direct contact with the individual practitioner, the Congress creates an international fellowship and an interscientific relationship that could scarcely be obtained in any other way. It brings the surgeons of the United States, Canada, and other countries of North America into the closest relations. It emphasizes the doing of things rather than the telling. It distinguishes the practical man from the purely theoretic or academic."

In his eloquent pleading for higher standards of surgery he gave all the weight of his authority to the need of proper preparation for its practice, and stressed the point that anyone who would profess to be a surgeon should at least give proof of that study and highly specialized training required to assume its responsibilities, by fulfilling at least a minimum standard of requirements, such as those now exacted by this College of all who seek its fellowship.

In addition, he preached character, honesty, and moral worth as indispensable qualifications for the practice of conscientious and good surgery. In this he subscribed to the magnificent ideas that our first president, Dr. Finney, sought to inculcate with all the strength, purity, and courage that are his by right of example, as the bottom rock upon which the principles that guide this College should rest.

Dr. Murphy was among the first to stress the importance of extending the propaganda for reform in surgery to the hospitals, sanitaria, and other institutions which are inseparably interlocked with the surgeon's work—the surroundings that tell of the surgeon's ability and conduct. To this great movement, which has contributed so materially to the reputation of the College as an agency for service in the interest of the public welfare, he gave, in its formative period, the great benefit of his advocacy and support.

Again, Dr. Murphy's conception of service in elevating the standards of American surgery is well shown in the whole-hearted support that he gave to the journal, SURGERY, GYNECOLOGY AND OBSTETRICS and THE INTERNATIONAL ABSTRACT OF SURGERY. As the editor, Dr. Martin, has written, "Dr. Murphy was the underlying support of this publication, from the time of its inception to the day of his death. He was the inspiration for every move of merit that the journal has stood for and fathered. Dr. Murphy was one of the few who maintained at the first conception of the journal that it would succeed if it were comprehensive and served the needs of the surgeon, and, to this ideal he inseparably attached his program of personal energy and financial aid." Through the generous action of Dr. Martin, the editor and proprietor, SURGERY, GYNECOLOGY AND OBSTETRICS has become the official organ of the College. No one now questions the enormous benefits that this publication has brought to the literary culture, to the technical achievements and the prestige of American surgery in the twenty years of its existence. In its value as the literary arm of the College and as the recorder of the activities of American surgeons this journal today fulfills and surpasses all the predictions of Dr. Murphy, before the publication had come into existence and before he had become the chief of its editorial staff.

Much more could be told of Dr. Murphy's participation in fostering and developing the program of the College and in giving shape to its ideals, but this is scarcely needed to show his profound concern in the welfare of this institution—a concern which continued unabated to the end of his extraordinarily useful life.

One feature of his character which is indirectly related to the history and progress of the College is his loyalty and devotion to his life-long friend Dr. Martin, our Director General, whose fertile brain first conceived and gave tangible form to all three of the great triad of enterprises—the Journal, the Clinical Congress, and the College of Surgeons, which will remain for all time testimonials to his genius for organization and as perennial monuments to his vision and statesmanship.

In his presidential address at the Clinical Congress in Boston in 1915, in referring to the difficulties first encountered in organizing the Congress, Dr. Murphy said: "There was one man who had vision, who outlined the organization, who took up the task of its foundation. By the positiveness of his convictions, by his indefatigable zeal, by his indifference to rebuff and contumely, by a courage founded on the knowledge that he was working unselfishly for a great and good cause; by his fidelity to the medical profession and his confidence that the majority of its members would finally appreciate the true worth of the purposes of the organization, he succeeded in founding the Clinical Congress of Surgeons. He first inspired a few, and then gathered a larger number of representative men and convinced them that the opportunity was at hand and the material available. I refer to its founder and present secretary, Dr. Franklin H. Martin."

Well-nigh eleven years have gone by since Dr. Murphy's stirring voice was heard vibrating

in our meeting places, but the echoes linger and still continue to evoke the admiration of all those who knew him and who have been under the spell of his magnetic personality. Those of us who, following in the wake of his ideas and his precepts, and who are here to carry on the program that he helped to formulate for the future of this College, may well ask ourselves what we have accomplished in these years, what the College has done to justify his expectations, to confirm his faith in the future of this organization and in its ever-increasing capacity for usefulness.

Fortunately, the answer has been given in no uncertain or doubtful terms, not once, but every year that has passed since Dr. Murphy's untimely death. A glance at the thirteen stout volumes, steadily growing larger, year by year, and at the files of the quarterly bulletin, which are prepared under the editorship of our Director General, will show the progress of this organization in its march toward the attainment of its objectives. A glance at these, we believe, will suffice to satisfy the most inquisitive and inquisitorial, that the College has not been idle or lagged behind in the pursuit of the task set before it by its Founders.

The increasing Fellowship now approaching 8,000, the great and growing popularity of the Clinical Congress, the great value of our scientific sessions in bringing the latest products of the laboratory and of scientific research to the eye and ear of the surgical practitioner, the education of the people by the wide dissemination of knowledge pertaining to the conservation of health and to the prevention and cure of disease; these and more are the direct benefits that accrue to the profession and the public through the annual Congress and the many regional meetings that are held in every section of the country.

In the short life of this association it has succeeded, by combined efforts, in profoundly influencing two outstanding reforms in medicine which are unique and peculiar to our profession, to our period, and to our country. One of these is professional and the other ethical: first, hospital standardization, with the enormous benefits that have followed the survey of the hospitals of this country and Canada by the experts of the College. 1,564 hospitals have been standardized in accordance with the minimum requirements prescribed by the College for official recognition and approval. This movement is now definitely and justly credited to the American College of Surgeons. Second, the organized fight against fee splitting and other debasing practices is inseparably associated in the minds of the profession and of the public with the successful crusade against this and other immoralities that has been carried on by the College.

While the College has put the impress of its principles upon the profession and the hospitals of the continent, and the benefits to the public are growing every day more appreciable, the College has still a long road to travel before it can reach the goal of its ambition. Both of these movements are speeding along and steadily gaining momentum, and the day is fast approaching when the standards of the surgeon and the hospital based upon a scale of minimum requirements will have to be advanced to still higher and more searching tests in order that the College may attain the best results.

And now as to our ideals, how manifold and multiform they are! Even as they are now unfolded before us, they are not mere fancies, will o' the wisps, or "the stuff that dreams are made of," but practical, tangible, and reasonable expectations. In our endeavor to standardize the surgeon and the hospital we are marching onward with a clear and definite objective. The public now knows that it is our purpose that only men who have given proof of their competence by fulfilling the requirements of the College should be entitled to public recognition and trust, as surgeons. We also want the public to know that it is our purpose that only hospitals which have submitted to the test of standardization are entitled to their confidence. We know that this is a big bill to fill, but we are not sparing ourselves in the effort to meet it. We may never completely eradicate all the evils that beset us, but we can at least minimize them so that the unworthy shall stand isolated and exposed, naked in all their ugliness, before the public eye. But, after all, is not our life one long campaign in behalf of other people against ignorance and dirt, falsehood and disease? The task of the reformer is hard; the frailty of human nature and the fallibility of human judgment proverbial. But if all the moral and intellectual forces which are represented by this College are united in the accomplishment of the task that we have set before us, are our ideals unattainable?

But these are only a few of the many ideals that we are striving for. There is our bureau of Inter-American relations which is to continue to expand our fellowship in the Latin American republics and to spread the evangel of the universal brotherhood of man in the service of humanity. And again there is our department of literary research, our library, our museum, the Ochsner laboratory of clinical research, the offices of the committees in charge of the investigation of cancer and of that

malignant disease of bone—sarcoma— and where all the great surgical problems of today and tomorrow will be threshed. All this work, all these enterprises, have been well begun and have yielded most fruitful results. But beyond these there are still other activities and utilities awaiting our further study and action, as we advance and our endowment increases. With the everlasting change that is ceaselessly going on in the world of medical science, new ideals will arise to replace the vanished concepts of the past and of the present.

And finally, as we contemplate the architectural beauty of this Memorial and consider its destiny, we may see that it is plainly written that it will become the center of the organized activities of the surgical profession resident in the Western Hemisphere. We now recognize, with glad acclaim, that this living monument, built in recognition of the scientific service rendered to humanity by one of the greatest exponents of our Science and our Art, marks an epoch in the relations of the medical profession and the public. It testifies in mute but unmistakable terms that the soul of surgery has found its place in the heart of humanity.

Is it not fitting that here, on the shore of one of the great lakes, in a city which vibrates with the dynamic energy of its millions of people, in a city still so young that the enterprising spirit of the pioneers who founded it has not been crushed by centuries of antiquity—should hold a memorial institution such as this that is looking to the future for the crowning glory of its service? "May it not be that these waters that restlessly lap on the not far distant lake shore, express the spirit needed by an institution of this young and aspiring type? Now tossed by tempests brewed from dark and lowering clouds; again the incessant beat on the shore of waves generated by the winds of the passing storm; now dark and angry as in a winter's day, with icy blasts and clouds of driven snow; once more quiet and serene in the calm of a summer's day—such are the moods of the lake, ever changing, always varying, and yet constant, enduring, magnificent—a mighty force continually at work from the changing activities of the lake with its reserve of enduring force."[1] May there come from these sources an inspiration and stimulation to this Memorial and to the workers who give it life—who, as the years go by, will lead it into the highways of progress, to the ultimate attainment of its ideals in every field of surgical usefulness and endeavor. To this end may this Memorial endure a lasting tribute to the starlit name it bears—John B. Murphy.

"A lofty name, a beacon light
On the cliffs of Fame."

And now, Mr. Chairman, by virtue of the authority vested in me by the American College of Surgeons, I have the honor to accept the John B. Murphy Memorial building as complete and ready for occupancy and pronounce it now open for the uses of the American College of Surgeons.

[1] H. A. Christian. Science, 1925, lxii, No. 1616; p. 551.

THE JOHN B. MURPHY MEMORIAL BUILDING, THE ATHENEUM OF SURGERY[1]

By WILLIAM J. MAYO, M.D., F.A.C.S., Rochester, Minnesota

WE meet today to dedicate the John B. Murphy Memorial building, a home of science and creative art in surgery.

Ten years ago, deeply grieved at the loss of a dear friend, I penned a tribute to Dr. John B. Murphy, and the analysis of his career that I then made has been amply justified by the mature thought of the following decade. It has been well said that by examining the life work and deeds of a man one can get an intelligent picture of his soul. Dr. Murphy had that divine discontent which leads to progress, and fires those geniuses who, by their researches and altruism, have given mankind their greatest blessings.

The reputation of a surgeon, in the final analysis, must rest upon originality, teaching by word of mouth, teaching by the printed page, surgical judgment, and operative skill. Dr. Murphy had a marvelously fertile and original mind. Possessing a brilliant surgical imagination, he early deviated from the beaten paths and invaded new territory, and yet with such acumen that nothing which he originated has failed to live. Like those of the great musicians, his productions are still masterpieces; they mark epochs in surgical progress. He made the experimental laboratory a handmaiden to surgery, and carefully investigated every detail of his constructive work by animal experimentation before applying it to man.

As a clinical teacher of surgery he had, in my opinion, no equal. Clear and logical, he started with facts about which there could be no dispute, progressed from these facts toward new ground, yet along pathways more or less familiar to all, and finally, taking us by the hand, so to speak, he led the way to new truths by the light of his surgical genius.

As one views this classic building devoted to the purposes of the American College of Surgeons, one must recognize that it is a worthy memorial to one of the greatest figures in American medicine. It is especially fitting that this edifice should be devoted to the elevation of the educational and moral standards of the profession which Dr. Murphy loved so well.

To the vision and altruism of Franklin H. Martin, the American College of Surgeons owes its existence. Dr. Martin early saw the fundamental weakness of the changing character of surgery as it had developed in America. Surgically speaking, we were becoming a nation of operators attempting by facile technique to gloss over serious errors in surgical understanding. The advice of David Crockett, "Be sure you are right, then go ahead," was sometimes honored in the breach rather than in the observance. The science and art of surgery in America had outgrown its methods of organization. Day by day the increase in available surgical knowledge was so rapid that it was no longer possible for one mind to obtain a good working knowledge of the various branches of surgery. The term, "general surgeon," no longer applied, and surgery for the general practitioner could no longer be justified.

In this rapid advance under changing conditions, undesirable practices grew up among surgeons for which the commercial and industrial age in which we live was largely responsible. The conception of an organization of surgeons of which the primary purpose would be service to the people made a strong appeal to the keener minds of the surgical profession, of which Murphy was the leading spirit. The undertaking, however, met with severe criticism which had its origin to a large extent in the conservatism natural to the profession. It cannot be denied that many honest men who, in conjunction with general practice, had been occasionally practicing operative surgery for which they were no longer properly prepared, thought they were being surgically disenfranchised. They strongly resented an organization which might even by suggestion impugn their motives or question their ability. The unprejudiced will recognize that it was necessary to change an obsolete custom which, while quite proper in the light of the small knowledge of an earlier day, when illumined by the great advances in surgery was clearly seen to be unfair to the patient. It required supreme courage for Dr. Martin to abandon an honored position in the surgical world and devote his fine talents to the new venture, and it is to the lasting credit of the surgical profession of America that its leading members, almost to the man, rallied to his support.

Fundamentally the model of the American College of Surgeons was the Royal Colleges of

[1] Address given at the dedication of the John B. Murphy Memorial Building, of the American College of Surgeons, Chicago, June 10, 1926.

England, Ireland, and Edinburgh. The conception of the American College is a tribute to the splendid work of the British institutions which insist, and properly, that learning is the keystone of the arch. The resemblance in details of organization, however, is not marked, because of the different conditions under which surgery is practiced in Great Britain and America. The British Isles are small, with large centers of population containing universities with great medical schools, to which patients can be transported quickly for surgical care, and the general practitioner, in conformity with British custom, perhaps the strongest factor in the Anglo-Saxon temperament, has never done and does not desire to do surgical work for which he has no training.

In America the distances between cities and seats of learning are great, and, since the object in organizing the surgeons was to insure that every patient with surgical disease had the most skillful care possible, an organization along different lines from those followed in Great Britain was necessary. A limited organization which would be more or less aristocratic intellectually would not, therefore, answer the purpose. Such organizations, for that matter, were already in existence, for instance the American Surgical Association, the American Gynecological Society, the American Laryngological Association, the American Ophthalmological Society, and others, organizations which were largely for men who were teachers or who had justly achieved a great reputation in practice in their particular specialties. It was generally recognized that in a country of 120,000,000 inhabitants, Canada and the United States, an organization of less than 10,000 members would leave many communities unrepresented and possibly without adequate provision for surgical care. Liberal provisions therefore were made to include in the fellowship many older men who had done good surgical work and only too soon would be replaced, as the inexorable time clock called them from the field. The requirements for the fellowship of the future, however, were placed on a higher plane. It was determined that the men who were to take the places of those of the older school, younger men who have had greater opportunities in modern institutions for medical learning and in hospitals for clinical training, must be held to a higher standard.

Very properly, emphasis has been thrown on wisdom as well as knowledge as a qualification for fellowship in the American College of Surgeons. A great many men are capable of acquiring large amounts of information which they are unable to use; and, since the first purpose of the American College of Surgeons was the proper care of the sick, it was early decided that the ability to make surgical diagnosis, and, when necessary, to operate with wisdom and with safety to the patient, should be made an essential to fellowship. Therefore, mere possession of academic degrees by its prospective fellows would not insure fulfillment of the purpose of the organization, and it was decreed that no man should be admitted to fellowship until a reasonable period, eight years, should elapse after graduation from medical school, in order to judge whether he was making proper use of his opportunity and was steadily progressing. Eventually the so-called Junior Candidate group, a probationary organization, was established to include, during their formative period, young men having the basic qualifications for fellowship.

There are, unfortunately, in every profession, and that of medicine is no exception, certain men who do not live up to proper professional ethics. In the practice of medicine a higher grade of ethics must be demanded than in any other profession, because the people are without knowledge of medicine and easily become the prey of charlatans and self-seekers who trade on their ignorance. It occasionally happens that a man, otherwise well qualified, justly comes under suspicion of unethical conduct in his relation with his patients and is therefore denied fellowship.

On speaking to a general audience, one avoids as far as possible the introduction of the question of professional ethics in the medical profession, those rules of conduct which are blamed, and usually unjustly, for the many real or fancied shortcomings in our professional relations. Yet experience has shown that in the long run the medical profession, although often unsympathetic, is just.

Today surgeons cannot intelligently practice surgery in such manner as to give the people the best that medicine offers, which is the least that they should have, unless each man is willing to recognize fully the dignity of his coworkers. The surgeon who works alone, who holds his fellow practitioners in contempt which he does not attempt to conceal from the patient, in the long run fails to do what is best for the patient because he does not have the co-operation and support of his colleagues, and therefore cannot secure the best conditions for success.

The wisdom of the provision that every applicant for fellowship in the American College of Surgeons must be judged by those who work with him or know him intimately is therefore apparent, and it is evident that the College in selecting its members rightly puts character first.

One of the most frequent criticisms of members of the medical profession is based on the fact that they are slow to adopt new ideas. This is true, especially with regard to those ideas which originate with men who have not had medical training, and who throw emphasis entirely on a method of treatment which has not been properly tested, either clinically or by animal experimentation. Occasionally such an idea possesses great basic value, but when one considers that the purpose of medicine is the saving of human life, immediate acceptance of every new theory would not be warranted, and extreme conservatism under the circumstances is amply justified.

In the early day, because of the many attendant dangers which have now, to a large extent, been eliminated, only operations of urgent necessity were performed. Today surgery of expediency is perhaps the chief work of the surgeon, the object being to prevent conditions which would later threaten life. This is especially true of malignant diseases in which early operation is usually curative, and late operation curative only to a small extent.

The education of the public in the past was left too largely in the hands of the quacks, charlatans, cultists, and self-seekers. As related to surgical disease, the education of the laity has been rightfully taken over, in a dignified manner, by the American College of Surgeons, that the benefits of modern medicine may be passed around.

The American College of Surgeons is vitally interested in the conditions under which surgery is practiced, and no part of the work of the organization has been of greater importance than the standardization of hospitals, and the development of proper hospital staffs and fine training schools for educating nurses. This pioneer work has greatly stimulated the building of hospitals and especially the community hospital where every sick person, without regard to color, creed, social, or financial condition, can be cared for properly. Correlated with this growth has been one of the most remarkable developments of modern times, the understanding by the laity that the sick member of the family can be better cared for in the hospital, without regard to money, than in the home crippled by sickness, because the favorable conditions afforded by the hospital cannot be duplicated in the home, no matter how wealthy the occupants.

The American College of Surgeons has been in existence thirteen years, and it is becoming increasingly apparent that the altruism not only of its founder, but also of that tower of strength, Dr. Murphy, who early in the history of the College supported it in every way, has brought forth an institution of extraordinary value to our country. The formative period has passed. The College has good endowments, a suitable home, and this beautiful building devoted to a great purpose, the advancement of learning, research, and medical education, always from the broad humanitarian standpoint of service. Its fellowship comprises over seven thousand carefully chosen men, controlled by a democratic organization of a board of governors of one hundred and fifty members, a board of regents, a president, and a director-general.

In the future, every young man who desires to enter the practice of surgery will find that energy, perseverance, and character will lead him to the desired goal. The requirements for fellowship are reasonable and within his reach.

The foundations of medical learning were laid in ancient Greece, and in Athens it had its home. The atheneum was a noble structure in which learning and the love of beauty in thought and fact were nourished. Beautiful as are the physical remains of this temple, even more inspiring are the undying evidences of a great culture which was never lost, although little regarded and often dishonored for nearly two thousand years. The Renaissance brought these evidences of culture to light to act as a guide for all time, proof that while the flame of the torch of learning may be dimmed, it cannot be extinguished while civilization shall last. Let us hope that this modern atheneum may fulfill its function in the years to come, a noble monument in memory of a noble man.

JOHN BENJAMIN MURPHY—CITIZEN AND SURGEON[1]

By FRANKLIN H. MARTIN, C.M.G., M.D., F.A.C.S., Chicago
Director-General, American College of Surgeons

WE build monuments to poets, musicians, politicians, and statesmen, and we dot our land and fill our parks with statues of our military heroes whose training and vocation have fitted them for the destruction of men; but how few monuments there are to the eminent members of the one profession whose training and vocation are concentrated in the saving of human lives!

This beautiful temple of service, to be devoted to the ideals of practical surgery, is one of the first in this country to do honor to a surgeon. Why was John Benjamin Murphy the first of the surgeons of America to be selected for this distinction? Why did laymen, medical men, surgeons, and friends contribute to this memorial to our neighbor and our citizen?

Murphy was a genius. A genius is one who creates something that is desirable, by perfectly obvious methods, and that by its simplicity and importance captures the imagination of his confrères and posterity. Murphy not only created and had his creations accepted, but by his impelling personality and eloquence, he inspired laymen and medical scientists alike.

His vision was phenomenal and was made practical by an industry that made his dreams come true. His accomplishments were epoch-making and few chapters in the text-books of the future can be written without reference to the pioneer work of Murphy. We are awed when we realize that Murphy was the first, or among the first, to develop: Suture of the blood-vessels; surgery of the chest; surgery of the brain and spinal cord; surgery of the appendix; surgery of the intestines, including the invention of the Murphy Button; and, finally, one of the greatest of his achievements, surgery of the bones and joints.

Murphy's accomplishments were of the first importance. He was not only an originator in these branches of surgery, but as well an authority universally recognized, and his name will be associated with these subjects so long as there is a surgical literature.

But Murphy was more than an inventive and a mechanical genius. He possessed the ability to impart his knowledge. He was our greatest interpreter of surgery. He was eloquent in speech. His was true eloquence, not mere oratory; and he carried his hearers by force of personality, thorough knowledge of his subject, an enthusiasm that was irresistible, and a directness of attack that left no room for misunderstanding.

Dr. Edward Martin, of Philadelphia, once said: "I go to Murphy's Clinic determined to remain unperturbed; but in five minutes I find myself on the edge of my seat, enthusiastically waving my hat." This confession by Edward Martin, no mean critic of dramatic art and a peer among teachers, will strike a responsive chord in every surgeon before me who attended the Clinics of Murphy.

As an interpreter, Murphy was a prolific writer. His many volumes of *Clinics*, published monthly, contained the very quintessence of his operating work, the very lifeblood of this master surgeon.

As an individual, he was first of all a family man, devoted to his wife and children, of whom he was justly proud and who in turn worshiped him. He possessed a strong religious conviction, and his church and his religious duties were always scrupulously attended to.

He was a great and loyal friend. In his later life, I was honored by his friendship. In my long acquaintance with him, I never heard him speak critically of any one. Like all great men and prophets, he was frequently "without honor in his own country."

On occasion, when injustices by word or deed were being done to him, I insisted that I and his friends would not tolerate these actions; that we would expose the detractor. He would raise his hand in protestation and, smiling say: "Oh, no, leave them alone; they know not what they do."

When Murphy died in 1916, at the early age of fifty-eight, he was mourned not only by those of us who were his neighbors, but by the whole world. Countless tributes were paid to him as a great surgeon and teacher by his Chicago confrères, and preserved by his family. May I quote a few of these? Dr. Albert J. Ochsner said: "Murphy was the one man whom the whole surgical world knew as a great American surgeon . . ." Dr. William A. Evans: "He was the greatest surgeon of his day in the world. . ." Dr. William E. Quine: "It is an open question whether the passing of a private citizen ever occasioned a more powerful or widespread shock than did the

[1] Presented at the inauguration of the John B. Murphy Memorial Building, June 11, 1926.

passing of our friend. Even distracted Europe felt the jar. A citizen of the world has passed away. . ." Dr. Frank Billings: "We soon forget, but we remember great landmarks." Dr. Frederic A. Besley: "The world has lost the greatest surgical teacher it ever had, and no man's mind can estimate the extent of the far-reaching influence of his teachings." Dr. Arthur Dean Bevan: "He was one of the most original thinkers American surgery has produced. . ."

From the medical profession throughout the country came tributes. Dr. Harvey Cushing, of Boston, said: "He stood second to none in the country and to few in the world." Dr. C. A. L. Reed, of Cincinnati; Dr. W. W. Grant, of Denver; Dr. Norman Bridge, of Los Angeles; Dr. John A. Wyeth, of New York; Dr. Emery Marvel, of Atlantic City; Dr. Stewart Lobingier, of Los Angeles; Dr. Robert Coffey, of Portland, Oregon; and Dr. William D. Haggard, of Nashville all spoke words of praise. Dr. J. M. T. Finney, of Baltimore, said: ". . . A wonderful personality, an inspiring teacher, a splendid surgeon, a true friend, a real man, his going has left a gap that can never be filled." Dr. William B. Coley, of New York, and Dr. Ingersoll Olmsted, of Hamilton, Ontario, spoke of his greatness. Dr. Charles H. Mayo, of Rochester, Minnesota, said: "He was the greatest surgical teacher of his time. Dr. Murphy will live in history as one of the greatest builders of modern medicine." Dr. George W. Crile, of Cleveland: "Dr. Murphy taught by monographs as others have taught by words, and his teachings have influenced not only the American continent, but also Europe and the Far East, for Murphy taught the world. . ." Dr. William J. Mayo, of Rochester, Minnesota: "In the death of Dr. Murphy, America has lost its foremost surgeon. His untimely death in the flower of his great career saddened us all. A man of genius, original, forceful, and of magnetic personality, he was honored above all men as a teacher in surgery."

And among others was the dean of surgery of this continent, Dr. William Williams Keen, of Philadelphia, who said: "He leaves a great legacy of an astonishing amount of the best work done by any surgeon in America. He has left his imprint on surgery for all time."

The surgeons of the old world took time in the midst of war to pay homage to the memory of Murphy, among them Sir Arbuthnot Lane, Bart., and Mr. Herbert Paterson, of London, England. Sir Rickman J. Godlee, Bart., of London, the nephew of Lord Lister, said: "I fell under the spell of Murphy's most original eloquence, which made hidden things clear, and shed over well known facts such a glamour that one seemed to be hearing of them for the first time from the lips of their discoverer. America has lost an incomparable teacher as well as one of her greatest surgeons." Professor Raffaele Bastianelli, of Rome, and Professor Theodor Tuffier, of Paris, also hesitated from war to pay their tribute. Sir Berkeley Moynihan, Bart., of Leeds, England, in summing up his eulogy to our hero in his John B. Murphy Oration, in 1920, said: ". . . Year by year Murphy grew in intellectual power and in the dominion he exercised over the minds of men. A problem took on a different aspect if Murphy were engaged in it. He touched the common currency of surgical thought and changed it into gold. For no effort of his was meaningless or sterile and all the powers of his mind and of his frail body were spent ungrudgingly in all his work. . . As we look backward upon the long history of the science and art of medicine, we seem to see a great procession of famous and heroic figures, each one standing not only as a witness of his own authentic achievements, but also as a symbol, of the traditions, ideals, and aims, of the age which he adorns. . . They are men whose deeds will not be forgotten, and whose names will live to all generations. Among such men, few in numbers, supreme in achievement, John Benjamin Murphy is worthy to take his place."

Statesmen, business men, and educators knew Murphy's worth and heralded his fame. Among them were Governor Edward F. Dunne of Illinois, President Edmund J. James of the University of Illinois, Harold F. McCormick of Chicago, Sir James Grant, of Ottawa, Ontario, and President Harry Pratt Judson of the University of Chicago. His eminent patient, Theodore Roosevelt, said: "Dr. Murphy was one of the most useful men in this country and one of the men who added to our reputation all over the world. He was a great surgeon of international reputation and he was as staunch and whole-hearted a patriot as this country had. He was a great American citizen." And Woodrow Wilson said: "The medical world loses one of its foremost figures and our country sustains a real loss. I am sure I express the feeling of the whole country when I mourn his going."

Probably the most unique recognition that any surgeon has received came to Murphy from His Holiness, Pope Benedict XV—the Christian Knighthood and the apostolic blessing, an honor which was conferred upon him in recognition of his services to humanity and of his many works of Christian charity.

Murphy was conspicuously honored by his confrères through the duties and distinctions they placed upon him. He was professor of surgery and chief of the surgical department of Rush Medical School, the medical department of the Chicago University; and subsequently he was made Professor of Clinical Surgery of Northwestern University Medical School. He was the president of the Clinical Congress of Surgeons of North America, and president of the American Medical Association.

So it is no mystery that this beautiful temple of service, the first of its kind to be built in this country by voluntary contributions of laymen and medical and surgical confrères, was created to honor Murphy, a member of the surgical profession. This building will be to America what the John Hunter memorial of the Royal College of Surgeons of England is to Great Britain and the whole surgical world.

Of this noble soul we may truly say:

> "He went away as he had lived, nobly careless of himself and thinking only of the things he had undertaken to do."

And may I further say of him that by thought, by action, and by self-discipline, he trained a body and mind, given by a pure inheritance, into a strong physique, an acute brain, and a dominating personality.

With unsatisfied industry he acquired the knowledge of his art and made his mind a possessor of the recorded deeds of his confrères of the world.

He learned surgery, serving with indefatigable energy the needs of helpless humanity, and taking counsel of his fellow workers in every field, old and new, in which his profession was practiced.

He had a creative mind, trained to investigate facts, and suspicious of traditions, with a courage to bring forth the new; a judicious mind that judged so correctly the value of the new his genius brought forth that the things he wrought were recognized by science as enduring principles.

With an irresistible enthusiasm, begotten by his appreciation of truth, he imparted the knowledge from his great storehouse in a way that appealed to the mind, the conscience, and the responsibility of his hearer, and that made him the impelling teacher of his time.

His experiments were made in the laboratory, in the mortuary, and in the dissecting room. He thus proved theories by facts, but never at the expense of those whom he served.

The impelling text of his life—in experiments, in writing, in the practice of his art, and in his burning utterances as a teacher—was: "Have uppermost in your mind the welfare of the individual who entrusts his life to your care."

He worked and pleaded for higher standards; he was democratic in his methods; and he condemned complacent, entrenched interests as a bar to progress. His life was a protest against ignorance and pretense. He believed that most things worth while came from those not bound by tradition. He encouraged the beginner and listened to the obscure.

He labored with more and more concentration of effort, as the wonders and possibilities of his task were revealed, trusting his strong body, inured by abstemiousness and continuous work, to perform the almost superhuman task imposed upon it. And then the body broke, and his life, in the fullness of its power, was sacrificed. "Greater love hath no man than this, that a man lay down his life for his friends."

He loved God and expressed this love through his work for men and little children. He was the devoted father, the beloved husband, the staunch friend, and an inspiration to all who came within his influence.

He was a human man who, through many years of self-discipline, indefatigable work, untold sacrifice, and desire of the highest service, developed into a superman—the high priest of the most exacting of professions.

And now, friends, before I draw the curtain over this inadequate sketch, may I venture to say that while we are here gathered to pay homage to Murphy, the great man, the great surgeon, and the true friend, we may be assured, if the screen is not too impenetrable, that around us, in approbation, are the spirits of him and of his devoted wife, and over us is shed their love and benediction.

THE AMERICAN COLLEGE OF SURGEONS[1]

By GEORGE W. CRILE, M.D., F.A.C.S., Cleveland, Ohio
Cleveland Clinic

THE primary purpose of the American College of Surgeons is thus stated in its year book:

The American College of Surgeons is a society of surgeons of North and South America which aims to include within its Fellowship all who are of worthy character and who possess a practical knowledge of the science and art of surgery. The College is concerned fundamentally with matters of character and of training, with the betterment of hospitals and of teaching facilities in medical schools and hospitals, with laws which relate to medical practice and privilege, and with an unselfish protection of the public from incompetent medical service.

As the above statement indicates, the founders of the American College of Surgeons felt that the public in general has the right to depend upon those who have had special training in any line to be the leaders in that line. Moreover, professional service of whatever nature, to be effective, must be of service to the public. Such public service must be exercised primarily through the avenue of public institutions. In the case of the medical profession the principal avenue of public service is, of course, the hospital.

According to the last report of the American Medical Association, there are 7,370 hospitals in the United States with a total of 813,926 beds, thus constituting a possibility of giving 297,082,990 days of service to patients in the course of a year; together with the 367 hospitals in Canada with a total of 31,445 beds, 308,560,415 days of service can annually be given to patients in these two countries, and according to published reports over 12,000,000 individual patients pass through these hospitals each year. The land, buildings, and equipment of these hospitals represent a grand total investment of approximately $3,187,000,000.

To one who has the sentiment to read into statistical figures an emotional significance, the first thought suggested by such huge figures would be that the sick public must be very completely provided for; and certainly this large investment of money bespeaks a very large and exceedingly generous public. But the above total of 7,737 hospitals in the United States and Canada includes hospitals of all sizes from those containing less than ten beds to those containing more than 300 beds, and it includes also not only hospitals of the highest degree of efficiency but also hospitals the efficiency of which is far below what the public has a right to demand. In addition, in the United States alone, according to a recent survey by the American Medical Association, among the total of 3,068 counties, 1,367 did not have a single hospital for general local service.

If the public, therefore, is to be wisely, efficiently, and abundantly supplied with hospital service, not only must more and larger hospitals be provided but it is primarily essential that a certain standard be established; and that by the publication from year to year of the list of hospitals which meet that standard, an impetus be given toward increased efficiency of hospital administration and of professional service.

Moreover, in addition to the care of the sick patients who occupy these 845,371 beds these hospitals serve as training schools for young physicians who have graduated from medical schools but must seek their first practical experience within the hospitals under the guidance of surgeons and physicians of experience. Some of these internes remain attached to hospital service but others go out into private practice, thus widening the sphere of ultimate usefulness of the hospitals far beyond even the indications of the huge figure given above. In addition, these hospitals also are the training ground for the tens of thousands of nurses required to care for our sick public.

For all these reasons the primary endeavor of the College has been the standardization of hospitals. In this campaign the closest co-operation and support have been given by the American Hospital Association, the Catholic Hospital Association, the Protestant Hospital Association, the Board of Hospitals and Homes of the Methodist Episcopal Church and the Baptist Hospitals. The American Railway Association has requested its 14,000 surgeons to use our approved hospitals wherever available, and to standardize the hospitals under their immediate control. General Hines asked us to survey the Veterans' Bureau hospitals so that the institutions for the care of soldiers may meet the requirements laid down for acceptable lay hospitals. The Marine Hospitals and Surgeon General Cumming of the Public Health Service also asked for our survey. The movement has met the approval of the great philanthropic foundations and the Carnegie Corporation has financed the hospital standardization activities of the College to the extent of $105,000.

[1]Presented at inauguration of the John B. Murphy Memorial Building, June 11, 1926.

From the time when this survey was first undertaken until the close of 1925, 10,862 individual surveys of hospitals had been made and 6,412 hospitals had been approved. The effect of these surveys is indicated by the fact that, whereas in 1918 only 12.9 per cent of the hospitals surveyed met the standardization requirements, in 1925, of 995 hospitals of 100 beds, 89.3 per cent met the requirements.

No report of this standardization program could be complete without a special word regarding the splendid sympathy and assistance of the Catholic Hospital Association under the leadership of the Rev. C. B. Moulinier, S. J.

The expense of this program is not slight, and until 1922 it was impossible to extend our work to the many hospitals containing less than 100 beds. Through 1925 slightly over one-half million dollars had been expended ($552,000), and it is to the everlasting credit of the American College of Surgeons that its Fellows have contributed this large sum for better hospital service to the public.

In order that hospitals may meet standardization requirements, the public at large must be cognizant of the need and must help to supply the necessary funds. Physicians and surgeons in each locality also must appreciate the possibilities of the program and must realize to what an extent it may promote their individual efficiency as well as the efficiency of hospital service. Therefore, it is important that the public at large as well as the individual physician should be cognizant of the advances in medical science, of the extension of public health control, of the way in which problems of such widespread individual significance as the cancer problem, for example, are being studied. To this end the College has inaugurated a plan of sectional meetings to give members of the profession throughout the country the opportunity of hearing scientific discussions by surgeons beyond their own territory, to give the public the opportunity of hearing addresses by leaders of the profession and by prominent lay-men, and to bring together hospital administrators in each locality for the discussion of the problems encountered by them in the standardization program.

The attendance upon these sectional meetings has increased steadily during the past year and these meetings have become, we believe, permanent institutions, helping the ideals of the College and the movement for hospital betterment. During 1925, 12 sectional meetings were held, covering 36 states and provinces.

We confidently believe that any report of the extent of interest and activities of the American College of Surgeons will soon become truly a Pan-American report. Increasing numbers of Latin-American surgeons are being included in the list of Fellows, and two official expeditions by officers of the College to South America have done much toward cementing a relationship which cannot fail to be of the utmost value not only to the surgeons of all the American countries but also to the public at large because of the increasing commercial and social relationships among these countries. In fact the international scope of the College should be emphasized by the statement that in addition to the countries in the Western continent, our list of Fellows now includes surgeons from Great Britain, Australia, New Zealand, India, Italy, Egypt, China, Korea, Syria, Turkey, and the Fiji Islands, to say nothing of the honorary fellowships which have been conferred upon distinguished surgeons in foreign countries. This international relationship was emphasized early in our history by the gift of the great mace to the American College of Surgeons by consulting surgeons of the British Army, in memory of mutual work and good fellowship in the Great War.

Any description of the organization and work of the College would be incomplete without a passing word as to the personnel responsible for carrying the load. Dr. Craig and his group have, with untiring zeal, carried the activities of the College to every state and province. Dr. MacEachern and his group not only have surveyed all hospitals of more than 50 beds in Canada and the United States, but he has just returned from a standardization trip made at the request of the Governments of Victoria and New South Wales, Australia, and New Zealand, in which he traveled 31,000 miles, and filled 279 engagements. Standardization service has been carried also to China, France, Porto Rico, and Uruguay.

In a single generation there arise only a few men with a genius and a passion for organization. Such a man, in my opinion, is exemplified in the person of our Director General, Franklin H. Martin. I believe that the past achievements, the present status, and the future outlook of the College could not have been created but for his fine and brilliant service.

Our present status includes a membership of 7,461; endowment funds contributed by the Fellows of the College, invested in gilt-edged securities amounting to $692,000; adding to this amount the value of our land and buildings, we have total net assets of over $2,000,000. But of far greater importance than this investment is a superb organization of able and tireless workers in every department of our activities.

THE SURGERY OF AMERICA[1]

By W. W. CHIPMAN, B.A., M.D., LL.D., F.R.C.S. (Edin.), Montreal, Quebec
President-Elect, American College of Surgeons

IT is indeed a great honor to speak for the Surgery of America; a great honor, and a large undertaking. And the task is not made easier, but is rather rendered more critical and more difficult in that I stand tonight with some of the greatest exponents of this handicraft, some of the most skillful surgeons of our time.

We have heard of the illustrious surgeon, in honor of whose name we are assembled, and of the American College of Surgeons, our own incorporate body of surgical associates, now some thirteen years in existence. And I am to speak tonight chiefly of the effort and the work that preceded these, the long endeavor that created as it were John B. Murphy, and the College that he loved so well. For, the Surgery of America is in very truth the ancestry, both of the Man himself and the Institution: a sterling ancestry of some three centuries.

Where American surgery has done so much the difficulty is great to say so little.

Thucydides said of the ancient Greeks that they "possessed the power of thinking before they acted, and of acting too"; and it is just this power of thinking and of acting that has set its seal upon this later Magna Graecia—our own America. This is our large inheritance, from the Northern Greek, the Anglo-Saxon race. The Pilgrim Fathers and the Virginia Company changed their sky, it is true, but they changed neither their character nor their characteristics. They brought with them their own race-qualities, a courage, a practical sense, an energy in work, and above all, a love of freedom; and they stamped these as a seal upon us, a lasting impress, for through chance and change we are, and we always will be, an English-speaking and an English-thinking race.

And the New World has but strengthened and accentuated these racial characteristics. Assuredly, there was a large house to put in order, and abundant need of energy, originality, and self-reliance. And so, from the beginning, through necessity of inheritance and environment, these have come to be the essential qualities of our national genius. And the surgery of America partakes of these things, for it bears, and has always borne, this self-same impress.

It is a record of three centuries; for, three hundred years ago, Giles Firman, Samuel Fuller, and John Winthrop practiced medicine in Massachusetts; while Lawrence Bohun and John Pott were fellow-physicians in Virginia. These men not only practiced medicine, but they took an active share in civil life; sometimes, in Massachusetts, even as the apostle Luke, they preached the Gospel, the "angelical conjunction" of Cotton Mather. Giles Firman was our first medical teacher, as usual underpaid; for, later on, he took Orders, finding physic, "but a meane help."

These men and their successors were our first practicing physicians, men of sterling worth and, the biographer naively adds, "men of constant if not warm affections." They practiced the surgery of their time, where Ambrose Paré of the famous ligature had already lived and died, and William Harvey had but just discovered the circulation of the blood.

A wonderful band of men—even from the beginning! For it was they and their successors who in due time founded our medical schools, and really created American medicine. Of such were John Morgan, Benjamin Rush, William Shippen, Junior, Samuel Bard, Caspar Wister, Phillip Synge Physick, John Warren, and James Lloyd. The very names are enough to recall their greatness. We read of James Lloyd, that he was an eminent surgeon in Massachusetts, using Paré's ligature instead of the searing cautery; that Benjamin Rush is justly named the American Sydenham; and that Phillip Synge Physick, who introduced the absorbable ligature, is called rightly, "the Father of American Surgery."

These were great men, and they lived in an auspicious time, for the revival of medicine in England in the 18th century was at its height. They had all worked and studied with John Hunter, the founder of scientific surgery, and the greatest scientist since the time of Aristotle; the one, be it remembered, a Greek, and the son of the Stageira physician, twenty centuries before; and the other a Scot, the son of the Calderwood laird. They had studied also with the great brother, William Hunter, with Samuel Sharp, Cheselden, and Pott. Seven of them were graduates of the University of Edinburgh, where they sat under the Monroes, Cullen, and John Bell. These were the men, and it was at this time that there were laid the foundations of American surgery. Morgan, Shippen, Rush,

[1] Presented at the inauguration of the John B. Murphy Memorial Building, June 11, 1926.

Lloyd, Warren, and Physick were in a manner the great prophets, the forerunners to prepare the way for the illustrious achievements that were soon to follow.

These illustrious achievements really began with ovariotomy, the progenitor, as it were, of all visceral surgery. You are familiar with the origin of this great project, and its execution. And so together we remember tonight Ephraim McDowell, born in Virginia, and who, inspired by the work of the two Hunters in London, and of John Bell in Edinburgh, in Danville, Kentucky, on the 13th day of December, 1809, performed the first ovariotomy. "I am but an instrument in Thy hands," was McDowell's prayer on that December morning; and an efficient instrument he proved himself to be; inasmuch as he gave to the world an operation, the value and the far-reaching effects of which we cannot overestimate.

For by this operation the gates were set ajar to the opening of a new surgical life. But these gates were slow to open, and we recall with pride today the names of Nathan Smith, David Rogers, the brothers Atlee, Edmund Peaslee, Burnham, Kimball, and Dunlap. It needed courage, I can tell you, in those pre-anæsthetic days—a courageous surgeon and a courageous patient. For these operations were condemned even by the profession, as being "cruel, barbarous, and unjustifiable," while among the laity, the operator was designated as a "butcher, a murderer, or a cross between the two." And yet they persisted, these intrepid pioneers.

And after the "ovarian hydatid," as the cyst was called, there followed soon the removal of the uterine fibroid, and the hysterectomy. Even the surgeon of today may mistake a soft uterine "fibroid" for a firm ovarian cyst, and it matters little to the patient as regards her safety. But how different the case in 1853, when Walter Burnham of Lowell, instead of an ovarian cyst, delivered through his incision an enlarged uterus with its fibroid. What was worse, it could not be replaced, and he was compelled to amputate where he could, this resolute, if reluctant, pioneer. But the honor of such a first case, deliberately undertaken, fell to his fellow-townsman, Gilman Kimball. Some 20 years later, Thomas Keith of Edinburgh, in dedicating his monograph on hysterectomy to Skene of Brooklyn, said: "I offer you something that is not mine, but is of American origin . . . . for the first case of uterine fibroid, diagnosed before operation, was removed by my old friend Dr. Kimball."

Today we can scarcely realize the relief, the joy that cometh in the morning, when to these courageous pioneers and their heroic patients there came as a veritable descent from heaven the use of Morton's ether-anæsthesia. The happy word "anæsthesia" was the gift of Oliver Wendell Holmes; and Weir Mitchell has poetically defined its slumber as "the death of pain." There is no doubt that Dr. Crawford Long of Jefferson, Georgia, was the first surgeon to use the inhalation of ether as an anæsthetic. But in the words of the Rev. Sydney Smith, the famous English divine, Long did not "compel mankind to hear him."

It was 4 years later, in 1846, that W. T. G. Morton, a dentist of Boston, inspired by a suggestion of C. T. Jackson, a chemist of that city, finally brought to a waiting world the glad tidings of sulphuric ether. Morton was a former pupil and a present partner of a fellow dentist, Horace Wells, the latter already known for his success and failure with nitrous oxide. And this same Morton was nothing if not daring and determined, and he compelled mankind to hear him. We can picture the scene of the first major operation in the Massachusetts General Hospital, the amputation of the leg of Alice Mohan. George Hayward was the surgeon, and Morton himself gave the anæsthetic, while among the spectators were the famous surgeons Henry Bigelow and Collins Warren. The operation was a painless one. And so humanity became possessed of one of the greatest gifts the high gods may bestow.

It is interesting to remember that chloroform was first used as an anæsthetic 2 years after this time, in 1848; and to recall the fierce opposition to the use of either of these drugs, ether or chloroform, during child-birth. Many eminent clinicians of that day argued that "it made the patient drunk, and no self-respecting woman would place herself under such an influence."

During these stirring times, about the middle of the 19th century, there were eight outstanding names in American surgery. There were John Collins Warren and Henry J. Bigelow in Boston; Marion Sims and Valentine Mott in New York; Benjamin W. Dudley in Lexington; Warren Stone in New Orleans; Samuel D. Gross in Philadelphia, and Daniel Brainerd, the founder of Rush Medical College, in Chicago.

These were indeed a famous octet!

The most celebrated name, perhaps, was that of Marion Sims, for was he not called upon to treat the Empress Eugenie at Saint-Cloud. There remain to his credit not only his epoch-making plastic work in bladder fistulæ, but a wide experience gained in the Franco-Prussian War, and embodied in his second great contribution to the surgery of his time, "The Careful Invasion of the

Peritoneal Cavity . . . . for All Intra-peritoneal Conditions." Following John Stough Bobbs of Indiana, Sims was the second man to perform a cholecystotomy for the removal of gall stones. His statue in bronze stands in Bryant Park, New York, erected by his "professional friends, loving patients, and many admirers throughout the world."

By this time the gates of major surgery were thrown widely open, and before the coming of Lister, it is interesting to observe the great results that were achieved. Amputation of the extremities was freely undertaken. John Collins Warren had already excised the hyoid bone, and accomplished an excision of the elbow joint. Henry J. Bigelow performed the first excision of the hip joint in America in 1852, and explained the mechanism of the iliofemoral ligament, named after him "the Y-shaped ligament of Bigelow." In New York, Valentine Mott was proving himself a worthy successor to Wright Post; Post a famous pupil,in ligation for aneurism, of the great John Hunter. Profiting by this example and applying the precepts of Horatio Gates Jameson, embodied in a Prize Essay, entitled, "Observations on Traumatic Hæmorrhage, Illustrated by Experiments on Living Animals," Mott proved himself one of the boldest and most skillful operators of the time. He resected the right half of the lower jaw, removed the clavicle for an osteosarcoma, tied many times the primitive carotid, the subclavian, the two iliacs, and the femoral, and finally performed a first ligation of the innominate. In the South, Benjamin W. Dudley's reputation rests mainly upon his operation of lithotomy, performed by him, it is said, 225 times.

But Samuel D. Gross was the greatest of them all. Sometime professor of surgery at Louisville and Philadelphia, and laureate of Oxford, Cambridge, and Edinburgh, he did more for the advancement of American surgery than any individual of his time. His talents were many and manifold, for not only was he an original investigator and a distinguished surgeon, but both as a teacher and a writer he was a notable exponent of his craft. He contributed valuable monographs on diseases of the bladder and on foreign bodies in the air passages; wrote a systematic treatise on pathological anatomy, and finally, in 1859, published in two volumes his famous system of surgery. This pathological treatise and the complete system were the first of the kind to appear in America.

A literature is the most authentic record of work accomplished, and it is interesting to trace the growth of this surgical literature. There was first published the work of John Jones in 1775, his "Plain, Concise, Practical Remarks on the Treatment of Wounds and Fractures," as he calls it; there followed "The Elements of Surgery," of John Syng Dorsey, in 1813; and, in 1824 "The Institutes and Practice of Surgery," by Professor William Gibson: and finally there appeared "The Complete System," by Gross himself. You will observe that this surgical literature marks a steady, step-by-step gradation during these 84 years. The record of this work appears all the more wonderful today inasmuch as Gross tells us that, in 1876 "there is not a medical man on this continent who devotes himself exclusively to the practice of surgery." Truly the Golden Age of the general practitioner!

And now we come to Lister. You will remember that he published his first report in 1867—two years after the close of the Civil War; and that, like so many prophets, he was at first without honor in his own country. James Chadwick tells us that he saw Lister operate in Edinburgh in 1873, and "swayed by the scoffings of my preceptors I failed to grasp the significance of his principles." Lister's scientific vindication came with the work of Robert Koch in 1876, and it was chiefly through Germany that this wonderful discovery was transmitted to us.

And now the kaleidoscope quickens, for by reason of anæsthesia and antisepsis, surgery had come at last to its own. The American Surgical Association was founded in 1880, 46 years ago, a gathering of the right men in the right place. And these men now passed from strength to strength, from one achievement to another; in the surgery of bones and joints, and in the three large cavities of the body, for the brain itself was not exempt.

One of the most brilliant chapters of American surgery is concerned with the vermiform appendix, the diagnosis and treatment of its disease. The first step in the recognition of appendicitis was taken by George Lewis of New York, in 1856. There followed, in 1867, the tentative operations of Willard Parker in simply evacuating the appendix abscess; and subsequently, the co-removal of the appendix itself by R. J. Hall of New York, and Thomas G. Morton of Philadelphia. A complete understanding of this lesion we owe to Reginald Fitz of Boston, while the indications of surgical treatment were definitely outlined in 1889, by Charles McBurney of New York.

No less brilliant was the history of the surgery of the intestines and the stomach. This began naturally with the repair of bowel wounds, and there followed from this the resection of the bowel

itself, and the various anastomoses. Intestinal wounds had long been a subject of great interest, and as early as 1805 Dr. Thomas Smith had presented this subject as his inaugural essay to the University of Pennsylvania. In 1843, we find Samuel D. Gross experimenting upon dogs as to the nature and treatment of these wounds, and applying these results to actual practice. After him there came the work of Charles Parkes and Nicholas Senn of Chicago; and of William T. Bull and Robert Abbé of New York.

Senn was an acknowledged master in intestinal surgery. He was among the early and successful experimenters in gastro-enterostomy and bowel anastomosis; and no small part of this experimental work was done in a laboratory under the sidewalk of his home in Milwaukee, before his final removal to Chicago. The use of decalcified boneplates, and inflation method for detecting bowel perforation, and his heroic service during the Spanish-American War made him pre-eminent. A prolific writer, perhaps his most important contribution was his "Pathology and Surgical Treatment of Tumors." He was the life-long friend of Christian Fenger, to whose knowledge of pathology he owed so much; his library and his gift of a Clinical Building to Rush Medical College, are in this city his visible Memorial. The work of Senn led naturally to the achievements of John B. Murphy, of whom we are hearing this evening. Albert J. Ochsner was for five years Senn's chief-of-staff, and began in this clinic his distinguished work.

A contemporary of Senn in the West was Maurice Richardson in the East. Maurice Richardson, assistant-professor of anatomy at Harvard, under Oliver Wendell Holmes, and later, Moseley professor of surgery, and surgeon-in-chief to the Massachusetts General Hospital! To the many new problems of the antiseptic era, Richardson brought his anatomical skill, a tireless energy, a gift of originality and clinical acumen. When he began his work, abdominal surgery, as we have seen, embraced little more than the occasional removal of an ovarian or uterine growth, for a recognized surgery of the appendix, gall bladder, bowel, or stomach did not exist. Richardson was a friend of Fitz, and was quick to corroborate and develop the latter's teaching concerning the diseased appendix, for in his first twenty years of practice he had operated upon some 757 of these cases. His first cholecystotomy for gall stones was reported in 1889, and in the subsequent years he did much to place on a solid foundation the surgery of the biliary tract. For a time he was greatly interested in brain tumors and in nerve injuries, so widening out the frontiers of modern surgery. After a strenuous life, it was given him to die in his sleep.

William Stewart Halsted became professor of surgery at Baltimore, in 1889. He was known to us all as an accurate, a thorough and painstaking surgeon; and he will be long remembered for his radical operation in cancer of the breast, his circular and bulkhead suture of the intestine, his work on the blood vessels, and the introduction in 1890 of the use of rubber gloves.

And so we come in this short and fragmentary way to the surgery of the present time; and I need not tell you that this wide domain of the healing art is in safe hands. There is so much that I have been compelled to omit, and not the least, all the brilliant work of the several specialties which constitutes so large a part of America's rich endowment.

Tonight the particular has been included with the general; even in respect of our minor prophets, "les petits prophètes," as Verneuil calls them, names unmentioned, but worthy of all honor and remembrance. At this time and in this place you will forgive one personal reference. It concerns Thomas J. Watkins, sometime gynecologist of St. Luke's Hospital, and professor of gynecology in Northwestern University Medical School: the late Dr. Watkins, whose special work our society admired so much and the friend we loved so well.

As we have seen, it all is the work of three centuries. During these three hundred years America has contributed generously to surgical resource; for she has given anæsthesia together with rich gifts of her own achievement.

Through all this long inheritance America has steadily pursued her practical individual way, adapting means to ends, and developing the particular measure of her gift. In respect of the future, she must concern herself with special thinking and research; for it is only with a right conjunction of thought with action, of science with art, that she can continue to be a growing point—the great growing point of coming generations. John S. Billings puts it well when he says: "it is quite probable that the John Hunter or the Joseph Lister of America is now busy with his preliminary work." We have faith to believe this; that such men are taking thought to add a cubit to our stature.

THREE DECADES IN SURGERY[1]

By GEORGE DAVID STEWART, M.D., F.A.C.S., New York

I HAVE been asked to speak of the changes that have taken place in surgery within the range of my experience; almost commanded, indeed, to summarize these changes, but, obviously only a few can be even referred to and these in the briefest way. A summary would be so tedious that I think it better to speak of the more striking changes as they appear to me. Dr. John B. Murphy, whose memory we are here to honor, belongs to practically the same period and did much important and enduring work in this era of development, improving technique and enriching the literature of the profession as much, perhaps more, than any man of his time.

Modern surgery dates from two men, Pasteur and Lister. Prior to their time, infections of wounds were the rule and the only surgery that was dared was the surgery of extreme necessity. Pasteur while studying wines showed that fermentation was due to certain small organisms in the air. Lister saw in fermentation a resemblance to putrefaction and soon proved that infection and putrefaction in wounds were like fermentation caused by certain small organisms that had been heretofore regarded as casual and concomitant. Lister's first efforts then were to control the germs in the air, for which he devised the famous carbolic acid spray—now a memory—and an impermeable dressing for wounds called the mackintosh, because it was waterproof. The spray had disappeared before I studied medicine, but the mackintosh was still in the textbooks, and I recall giving a good deal of time to memorizing its layers just prior to an examination. About that time, however, the air as a purveyor of germs to wounds was losing its relative importance and it was being realized that the hands, instruments, dressings, and every other thing that came into contact with the wound were more dangerous. For the purpose of cleansing the hands, bichloride of mercury was in common use and solutions of 1:1000, 1:5000, and even stronger were employed. I recall pouring, at the suggestion of my visiting surgeon, a strong solution of bichloride into the peritoneal cavity in a case of suppurative peritonitis with a result that was so promptly disastrous that I never did it again. In later years I read a story of Ambrose Paré, the John B. Murphy of his time, at the Siege of Milan which recalled my experience. Boiling oil was then the usual method of treating wounds and on one occasion after a battle, the supply of oil falling short, Paré, much to his regret, was compelled to treat some of his poor wounded soldiers with oil of roses and Venice turpentine. He relates that he could not sleep that night, like many another poor surgeon the ages through, so rising early he visited the hospital tents to find that the men without the boiling oil dressing were much more comfortable than those who had been treated *secundem artem*. He never used oil again. Instruments, in my time, were sterilized by soaking them in a solution of carbolic acid, and the catgut for sutures was kept continuously in juniper oil, a process which, while destroying ordinary germs, had little effect on anthrax and the more resistant spores.

Our ideas of germs were then very vague and it was not fully realized by everyone, I doubt if it is fully realized even now, that the germs were *in* the tissues, not sitting on top of their epithelial worlds. Because of this conception, great quantities of antiseptic solution were poured over the field of operation into wound cavities, particularly infected cavities, with much the same idea of mechanical cleansing as that held by the maid who flushes with water the kitchen stairs. In consequence, in many clinics rubber boots and aprons were a part of the surgeon's equipment and the operator who had neither, particularly if he went to a country home to operate, often returned, no matter what his political affiliations, belonging distinctly to the *Wets*. This was truly the age of antiseptic surgery when the aim was to find a solution to kill the germ but spare the patient; a quest which has continued unsuccessfully ever since.

This was succeeded by the *aseptic* period, when the effort was not to destroy the germs so much as to avoid them, and it is in this period that we are operating today; when soap and water and alcohol and iodine and other non-irritating fluids are relied upon to cleanse the field of operation and hands—the latter being protected further by rubber gloves, one of the really great discoveries of surgery—when instruments and dressings are boiled or steamed and sutures are prepared by various methods, but always by specialists. So thorough is surgical asepsis now that very few operative infections occur, and in the opinion of many, efforts in this direction have been carried about as far as it is possible to go. Asepsis, however, does not take care of the infections that occur outside

[1] Presented at the inauguration of the John B. Murphy Memorial Building, June 11, 1926.

of the surgical amphitheatre following wounds or disease, and for the treatment of these, new antiseptics are being constantly tested and recommended. There is, thus, to some extent a reversion to the days of antiseptics; but no solution has yet been found that is entirely successful and capable of destroying the germs circulating in the blood—in blood poisoning, etc.

The white blood cells derived from the reticuloendothelial system possess powers of defense and repair so remarkable that our greatest surgeon has said that "the decision to operate in an acute condition may finally rest on a rising white cell count." My colleague, Arthur M. Wright, has demonstrated experimentally that a few drops of blood, that of the patient or the experimental animal, injected into the pleural or peritoneal cavity, will promptly cause a decided rise in these cells, and in a case of osteomyelitis where the cells continually kept going down below the danger point, he was able to increase them by this method, saving his patient. Our knowledge of these remarkable cells also belongs to the era in surgery of which we are speaking.

If modern surgery dates from the discoveries of Pasteur and Lister, the application of their discoveries to the treatment of wounds was made possible by another discovery—that of anæsthesia. No matter what assurance might be given the patient as to freedom from infection and inflammation, there would be few to accept this guarantee unless there could also be offered the solace of unconsciousness. Local anæsthesia, a remarkable addition to the surgeon's resources, is almost entirely a development of this period of surgery. Cocaine—someone has said that so valuable a discovery in medicine only happens once in fifty years—the first of these local anæsthesias, contained poison atoms in its molecule. Analytical chemistry eliminated these atoms, and synthetic chemistry, the wonder field of modern science, has built up a number of drugs similar in action but without the toxic dangers.

In this development of surgery, John B. Murphy took a commanding part. His pioneer work in intestinal surgery and the button he devised for intestinal anastomoses was immensely valuable when our asepsis was so precarious that speed in operation was a factor of greater importance than now. The little instrument, the button, while not now so essential, is still used and useful. Some books are peculiarly long lived, particularly those that record the mental workings of the philosopher and the poet. Many books from the great minds of Greece are as vital today as they were more than two thousand years ago; like the Grecian marbles, they are merely mellowed by the passing of the centuries. Textbooks, on the other hand, and medical books in particular are strikingly ephemeral; but the chapter written by John B. Murphy on appendicitis still adorns American surgical literature. It is lucid, comprehensive, complete, and its reading is strongly recommended to all students of medicine.

In suppurative peritonitis the necessity for prompt opening of the abdomen and drainage for handling the tissues gently and retiring speedily and the subsequent treatment by the Murphy drip (Dr. Murphy had a sense of the dramatic and named his instruments and his maneuvers well) were also most valuable contributions. Surgeons are still grateful to him for that work, for by it he taught them to save the lives of many patients.

When I began the practice of surgery we examined the heart with a stethoscope; boiled the urine for albumin; looked at the sediment through the microscope for casts, and on our experience we estimated the patient's resistance. Today, tests of the blood, the kidneys, the liver, and heart not only render it possible to make much more accurate decisions as to operability, but medicine (and here the terms surgery and medicine are used interchangeably) is recognizing disease in the earlier stages often while it is still curable. Whole libraries have been written on blood and blood chemistry, and yet when I was a student, leucocytosis as a sign of inflammation was only mentioned. It was not until some years later that it was utilized. Based on reliable statistics, the range of operability and curability has been greatly extended in these more than three decades and the end is not yet.

To indulge in prophecy is human and pardonable; to attempt to peer into the future is in some sense a cry for immortality, an immortality which all men hope for and a few achieve. If I might so indulge, and all people of my race lay claim to some degree of second sight, I would predict, first, that our future development lies in co-operative effort, and, second, that it will be in the field of biochemistry or physiochemistry; a distinction between the two cannot be made.

Many examples of co-operative efficiency were furnished during the War. When it became obvious that poison gas was to be of prime importance, the Government called to Washington chemists but soon found that to these must be added pharmacologists and pathologists. These groups working together under one roof and to the same end achieved results in an incredibly short space of time that otherwise might not have been accomplished at all. Nor is it always necessary

for this purpose of co-operation to have the resources of a government. In America, in the Mayo clinic, we have the best example of correlated activity in medicine—a movement which has brought great gain to medicine, directly attributable to the clinic, and has also furnished an example for co-operative effort elsewhere over the whole world. In Liverpool, a group of men working together correlating results with a very meager endowment under which they were able to hire a chemist and a physicist, have discovered or, if not that, have opened a trail that may lead to the discovery of a cure for cancer.

Such co-operative effort extended so as to embrace other countries might offer an explanation as to why 700 surgical beds in Cairo only offer between twenty and thirty cases yearly of appendicitis. The Egyptians have appendices but no appendicitis.

It is one hundred thousand years from the Eoanthropus or dawn man of the marlbeds of Sussex to our time; fifteen to eighteen thousand years separate us from the men of the old stone age; it is only one hundred years from the horse-drawn cannon of Waterloo to the tanks of the Marne; from the Dover mail to the air mail. It is only one hundred hours from Rome to Alaska via the North Pole. Our last rounds up the ladder of civilization and down the Ages are being taken faster and faster and we may be in danger of falling off. Such falls have happened; and if others threaten, the doctor must tell the statesman how to avert them. Trotter has pointed out that with all his science, man, the multicellular complex organism, cannot save himself from the single celled amœba and has added that if steps in this direction are not taken nature may brush man from her work table to make room for another of her tireless experiments. Perhaps this is a gloomy view, the attitude of age, the depression of senility. Pennell, the artist, is reported to have said shortly before his death that women were not so good looking as formerly; and Sylvestre Bonnard, the genial old philosopher of Anatole France, says to the *Avocat* who is complaining of the shortcomings of the younger generation: "Yes, yes. And do you know lately I've noticed my stairs more difficult to climb?"

No! civilization does move and we like to believe that it moves forward, some recent historians to the contrary notwithstanding. The Greeks were great, but in many directions only thinly separated from the savage; and it is true that in 1456 malefactors were boiled in the caldrons of the Swine Market in Paris. Civilization must move; our profession must move, both are dynamic, not static; and change is life. With this in mind let me end on a sentence of Havelock Ellis: "The present is in every age merely the point at which the past and future meet and we can have no quarrel with either. There can be no world without tradition; without life there can be no movement. As Heracleitus said at the beginning of modern philosophy, we can never bathe twice in the same stream but as we now know the stream runs in an unending circle. There is never a moment when the new dawn is not somewhere breaking over the earth and never a moment when the sunset ceases to die; we should greet the new dawn serenely, not hastening toward it with undue speed nor yet leaving without regret the dying light that was once dawn."

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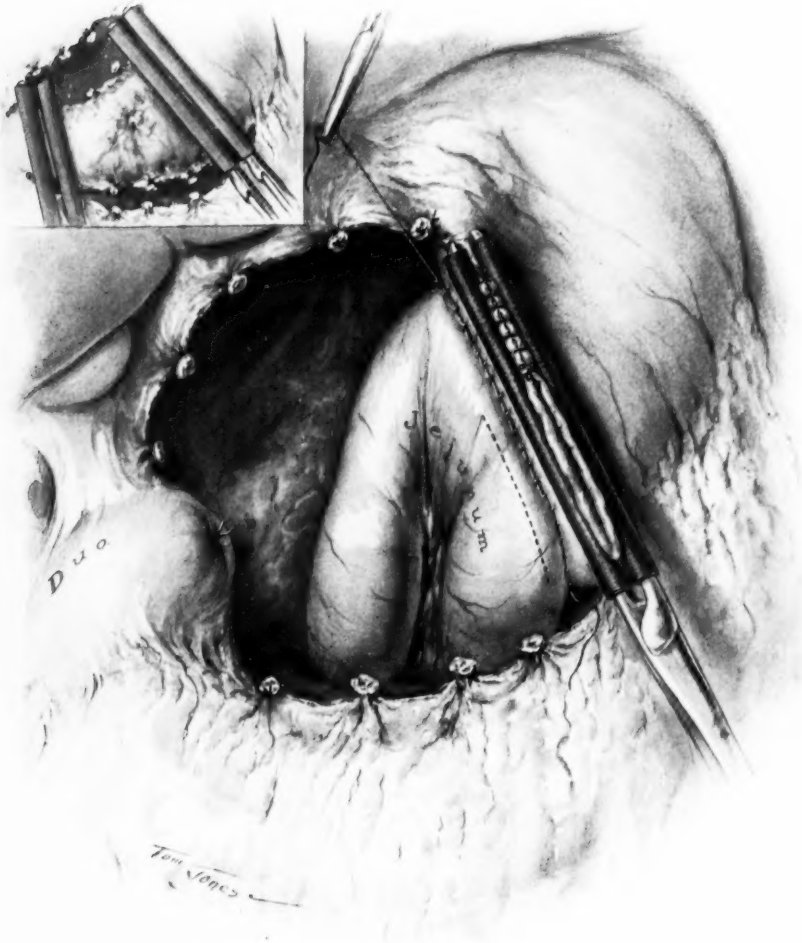

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